The New Zealand
Journal of Agriculture.

VOL. 53. WELLINGTON, 20TH JULY, 1936. No. 1.

MANAGEMENT OF PIGS ON DAIRY FARMS.

A SURVEY OF SOME MANAGEMENT FACTORS INFLUENCING THE RETURNS FROM PIG-FATTENING ON DAIRY FARMS.

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A FARM survey covering the production of pig-meat from dairy farms was commenced by the Manawatu-Oroua Pig Development and Recording Club in 1932–33, and has been continued during the succeeding seasons. The object of the survey was primarily to ascertain the practical possibilities of pig-production in association with dairying under ordinary farm conditions.

The results of the 1932–33 season(1) indicated that the production of 40 lb. of pig-meat (dressed weight) was not only practicable but in accord with the average results of farms employing reasonable management methods. It was also clear that the expression of returns from pig-raising in terms of the output of flesh per 100 lb. of butterfat provided a convenient and effective means of measuring the efficiency of pig-production on such farms. It was further evident that additional information, covering a larger number of farms, was necessary to give a more precise measure of the influence of certain factors indicated to be of importance in securing high pig returns. Wide differences in efficiency were apparent between individual farms; it is not sufficient merely to attribute such differences to "management"; rather it is the details of management which are important and upon which there is a definite need for reliable information.

While it is recognized that it is impossible, with the facilities available and with the use of the survey method alone, to investigate fully the many and interacting factors which may be broadly classified under the head of "management," it was hoped to obtain information on certain major aspects which possibly affect returns.

Throughout the survey the work covered a very much larger number of farms than those actually included in this analysis. Many records had to be discarded owing to lack of essential information, due not to any fault of the farmers who co-operated in the work and to whom the Club gives thanks, but to the fact that many dairymen are too fully occupied with other duties to keep accurate records of the data required. For the same reason the survey was of necessity confined to the collection of major details only, and many points which are essential for a reasonable study of pig-management could not be examined.

Summary of Results.

The following results cover the three years' records and include approximately fifty farms :—

Table 1.—Gross Production of Farms.

Year.	Number of Farms.	Number of Cows.	Number of Acres.	Total Butterfat.	Total Pig-flesh.
				lb.	lb.
1932–33 ..	11	755	1,142	180,230	62,968
1933–34 ..	29	1,434	2,565	402,207	162,332
1934–35 ..	14	641	1,230	173,746	80,375
Total ...	54	2,830	4,937	756,283	305,675

Table 2.—Average Production of Pig-flesh.

Year.	Pig-flesh per 100 lb. of Butterfat.	Pig-flesh per Cow.	Pig-flesh per Acre.	Calves reared per 1,000 lb. of Butterfat.	Meals used per 100 lb. of Meat.	*Cash †Returns per Pound of Butterfat.	
						Gross.	Net.
	lb.	lb.	lb.	lb.	lb.	d.	d.
1932–33 ..	34·9	83·4	55·1	0·1	14	1·4	1·35
1933–34 ..	40·35	113·2	63·3	0·08	30	1·6	1·47
1934–35 ..	46·4	125·4	65·3	0·07	42	1·85	1·64
Totals ..	40·4	108	62	0·08	29·8	1·62	1·49

* Cash returns based on pig-flesh at 4d. per pound. † Net cash returns based on gross returns less cost of all meals used at £9 per ton.

	Pig-flesh. lb.
Highest yield per 100 lb. butterfat	72·3
Lowest yield per 100 lb. butterfat	21·5
Highest yield per cow	206·2
Lowest yield per cow	54·7
Highest yield per acre	164·9
Lowest yield per acre	30·5

Highest ratio of sows to dairy cows—1 : 4·5 ; yield in pig-flesh per acre = 69·2 lb.
Lowest ratio of sows to cows—1 : 18·0 ; yield in pig-flesh per acre = 30·5 lb.
‡Highest cash return per pound of butterfat—Gross, 2·9d. ; net, 2·13d.
‡Lowest cash return per pound of butterfat—Gross, 0·9d. ; net, 0·8d.
‡Highest cash return per cow—Gross, £3 8s. 9d. ; net, £2 13s.
‡Lowest cash return per cow—Gross, 18s. 7d. ; net, 15s.

Consideration of the above figures indicates—

(*a*) That the average level of efficiency on the farms covered has increased each year from 34·9 lb. of flesh in 1933 to 46·3 lb. of flesh per 100 lb. of butterfat in 1935.

(*b*) That the increase in yield has been accompanied by an increase in the quantity of meals used to supplement dairy by-products.

(*c*) That the increase in yield has been accompanied by an increase in the cash returns per pound of butterfat, after paying for the meals used.

(*d*) That there is a marked variation in the efficiency of pig-production on different farms.

The highest farm, with an output of 72·3 lb. of flesh per 100 lb. of butterfat, £3 8s. 9d. per cow, and 2·9d. per pound of butterfat, is more than three times as efficient as the lowest farm, with an output of only 21·5 lb. flesh per 100 lb. of butterfat, 18s. 7d. per cow, and 0·9d. per pound of butterfat.

‡ All cash returns based on 4d. per pound for pig-flesh and £9 per ton for meal.

The high average level of production achieved by the fifty-four farms is extremely satisfactory in providing a guide to what is possible, and reflects considerable credit upon the individual farms concerned. Over 20 per cent. of the farms show an output of 50 lb. of flesh and over per 100 lb. of fat, while only 11 per cent. fell below 30 lb. per 100 lb. of butterfat.

Although this level of production (40·4 lb. per 100 lb. of butterfat) is more than double the Dominion average, and although the farmers considered are thus making far more effective use of their dairy by-products than the majority of their fellow-farmers, the conditions and methods employed are in no degree elaborate or involved. Indeed, it may be stated safely that the housing, equipment, stock, and general methods of feeding and management fail to reach to standards advocated by the recording clubs of the Dominion. In other words, the production has been obtained at little overhead cost, and the cash return figures given in Table 2 are virtually the net cash returns obtained from pig-raising on these farms.

In view of this, the opinion of the recording officer, who was closely in touch with the farms concerned in the course of collection of the figures, as to the major reason for the good results obtained is worthy of attention: "That if any reason can be given in general terms for the relatively high level of production obtained, it lies in the fact that the individual farmers concerned have, as a whole, a greater personal interest in pig-raising and a better realization of its possibilities as a supplementary source of revenue on the dairy-farm than has the majority of farmers. This 'interest' is reflected in more efficient all-round management, but has in no way involved undue overhead costs in the form of elaborate equipment, expensive stock, or increased labour requirements."

Factors in Pig-management contributing to High Production.

Examining the records of the whole fifty-four farms on a basis of the output per 100 lb. of butterfat, it is possible to obtain some information on several of the broader aspects of pig-management which may exert an influence on returns. In the following table the farms are grouped according to the production per 100 lb. of butterfat:—

Table 3.—Farms grouped according to the Output of Pig-flesh per 100 lb. Butterfat.

Group: Flesh per 100 lb. Butterfat.	Number of Farms in each Group.	Average Flesh per 100 lb. Butterfat.	Sow-Cow Ratio.	Number of Pigs reared per Sow.	Pigs bought.	Type of Trade.			Meal used per 100 lb. Meat.	Cash Returns per Pound of Butterfat.	
						Bacon.	Pork.	Weaner.		Gross.	Net.
		lb.	1:		Per Cent.	Per Cent.*	Per Cent.*	Per Cent.*	Per Cent.	d.	d.
60+	3	68·0	5·4	15·8	2·7	6·7	87·8	5·4	84·5	2·72	2·1
50–55	8	53·5	7·1	13·7	2·6	39·2	54·9	5·9	48·9	2·14	1·86
45–50	9	47·1	7·5	13·2	0·9	24·7	60·6	14·7	32·5	1·88	1·71
40–45	12	41·8	9·5	12·5	9·1	43·4	40·2	16·4	24·1	1·67	1·56
35–40	9	38·3	11·0	12·6	6·4	37·0	61·3	1·7	40·5	1·53	1·36
30–35	7	32·0	11·4	8·3	22·8	51·2	41·5	7·3	16·5	1·28	1·22
30–	6	25·9	12·7	8·6	18·7	60·1	38·3	1·6	7·2	1·04	1·02
Fifty-four farms		40·4	10·0	12·3	7·4	37·7	53·2	9·1	29·8	1·62	1·49

* Percentage of total output on weight basis.

From Table 3 it would appear that three factors are associated with high yields of pig-flesh per 100 lb. of butterfat :—

(*a*) A high ratio of breeding-sows to dairy cows.

(*b*) Efficient sow-management, as indicated by the number of pigs reared annually per sow.

(*c*) The use of meals in reasonable quantities to supplement separated milk.

The influence of the type of trade upon the production of pig-flesh is not so clear, though the figures suggest that concentration upon the production of pigs of light weights—porkers and weaners—is associated with higher yields than is the production of pigs of heavier weights—baconers. The avoidance of purchasing pigs for fattening appears to be the policy of farmers producing at a high level of efficiency.

From the economy or cash-return viewpoint, the advantage of high outputs per 100 lb. of butterfat is obvious, both higher gross and net returns per pound of butterfat resulting from high yields. It is also of interest not only that the use of meals is associated with high yields, but also that the net cash returns after paying for the cost of meal increase with higher levels of meal-consumption.

The Importance of the Sow-Cow Ratio and Efficient Sow Management.

It will be clear that the significance of the sow-cow ratio figures in Table 3 is dependent upon (*a*) the number of pigs reared per sow, (*b*) the number of pigs purchased, and (*c*) the type of trade. Two farms may have the same balance of sows to cows, but the two farms may not be comparable owing to a difference in the efficiency of sow-management leading to differences in the number of pigs reared per sow. Similarly, a low sow-cow ratio may be compensated for by the purchase of pigs for fattening. Again, owing to the fact that a bacon pig is approximately twice the weight of a pork pig when marketed, the same output of flesh could be obtained with only half the number of sows under bacon-production as under pork-production, assuming the same number of pigs to be reared per sow.

To obtain a more definite indication as to the relative influence of different ratios of breeding-sows to cows, it is thus necessary to take these three factors into consideration. This can be done by calculating the "effective sow-cow ratio" for each farm by adjusting the actual ratio, the actual number of pigs reared per sow, and the number of pigs purchased per sow, to a standard of fourteen pigs reared annually per sow. The influence of type of trade can be allowed for by examining the farms on a basis of those producing above and those producing below certain levels of bacon-production.

This has been done in Table 4A and Table 4B (next page), where the farms are grouped according to the "effective sow-cow ratio," and show the relative productive efficiency per 100 lb. of butterfat for different ratios.

Productive Efficiency : Effective Sow-Cow Ratio.

The expression "effective sow-cow ratio" combines the effect of the actual sow-cow ratio and the efficiency of sow-management as

well as taking into account pigs purchased. It will be seen from the tables that both on farms where pork-production predominated and where bacon-production predominated the maintenance of a reasonable balance between sows and cows, together with good sow-management, is essential to the attainment of a reasonably efficient yield of meat per 100 lb. of butterfat.

Table 4A.—Farms producing under 50 per Cent. Bacon.

Group Range: Sow-cow Ratio.	Number of Farms.	Average Ratio Sows to Cows.	Average Yield Pig-flesh per 100 lb. of Butterfat.
1 :			lb.
4·5 to 6·5	11	1 : 5·6	55·4
6·6 to 8·5	11	1 : 7·5	43·4
8·6 to 10·5	8	1 : 9·8	40·0
10·6 and over ..	6	1 : 13·0	31·3

Table 4B.—Farms producing over 50 per Cent. Bacon.

Group Range: Sow-cow Ratio.	Number of Farms.	Average Ratio Sows to Cows.	Average Yield Pig-flesh per 100 lb. of Butterfat.
1 :			lb
8·0 to 12·0	6	1 : 10·1	46·3
13·0 to 16·0	7	1 : 15·4	34·1
18 and over	5	1 : 27	26·3

The most efficient farms in both groups—*i.e.*, pork and bacon—are those with a high "effective sow-cow ratio," or, in other words, farms carrying from 1 sow to 5 to 7 dairy cows, and rearing fourteen pigs per annum per sow, in the case of predominantly pork-farms, and from 1 sow to 10 to 12 dairy cows, rearing fourteen pigs per sow, in the case of predominantly bacon-farms.

It must be emphasized at this stage that, while it is undoubtedly essential to carry a fair proportion of breeding-sows to dairy cows if high yields are desired, it is possible to carry this aspect to extremes. A high balance between sows and cows necessitates a corresponding efficiency in general management. The dangers of overstocking in this connection are very real, and, from observations, are quite an important factor contributing to the disappointing returns of many farmers. Examination of the individual records of the farms show that in the group carrying from 1 sow to 4·5 to 6·5 cows, the production varied from 70 lb. of flesh to 44 lb. per 100 lb. of butterfat. On the other hand, good management in other respects may compensate for low efficiency in respect to number and management of sows, as illustrated by the very fair return of 42 lb. of flesh per 100 lb. of butterfat from one farm carrying only 1 sow to 11 cows, and producing mostly pork.

While the general situation is certainly as shown in Table 4A and Table 4B, and a sufficient number of pigs must be available to utilize the separated milk produced, this is only the preliminary stage in the raising of pigs, and it must be accompanied by comparable efficiency in other respects if high returns are to be obtained.

The Influence of Supplementary Meals upon the Efficiency and Economy of Production.

From Table 2 and Table 3 there is an indication that the use of supplementary meals along with the dairy by-product has been associated with both more efficient and more economic returns. This aspect of management is further examined in Table 5, in which the farms are compared on a basis of varying levels of meal supplementing per 100 lb. of meat produced.

Table 5.—Productive Efficiency: Use of Supplementary Meals.

Group: *Meal per 100 lb. Flesh.	Number of Farms.	Average Meal used per 100 lb. Flesh.	Yield of Flesh per 100 lb. of Butterfat.	Range of Yield of Flesh per 100 lb. of Butterfat.	Cash Returns per Pound of Butterfat.	
					Gross.	Net.
		lb.	lb.		d.	d.
No meal ..	8	Nil	36·1	47·9–23·9	1·45	1·45
Up to 20 lb. ..	18	11·4	39·1	50·9–22·0	1·56	1·51
21 lb. to 60 lb...	10	35·7	45·1	52·2–40·1	1·80	1·63
60 lb. to 100 lb.	9	79·5	54·5	72·3–43·8	2·18	1·72

* The meal covers all meals purchased and home-grown, the latter also being charged for at the same rate as the former—viz., £9 per ton. Flesh is valued at 4d. per pound.

Table 5 provides interesting confirmation of the tendency already exhibited for high results to be associated with the use of a certain amount of supplementary food. It will be noted that, in the group using only an average of 11·4 lb. per 100 lb. of meat produced, there is an increase in output of flesh, though not materially greater than that of the no-meal farms. The group using the highest quantity of meal has by far the highest output of flesh.

On a cash-return basis it will be observed that in each group the net-return figure increases with the increase in the amount of meal used. In this connection it must be observed that actually the bulk of the meal used was grown on the farms concerned, and that even bought meal is charged for at a higher price than actually was paid in many cases. It is obviously essential, however, for comparative purposes to charge for home-grown fodder, and to adopt a flat rate for the purpose.

Just as in the previous section, dealing with sow-cow ratio, management in respect to other factors is of considerable importance. The mere provision of meal will not of itself produce high returns or economic returns. In this connection the column in Table 5 showing the individual range of farm production shows how on some farms using very little meal good results were obtained, while on others, using relatively larger quantities, the output was not at a particularly high level. It is significant, however, that both the maximum and minimum range of production increase as the amount of meal increases.

It is also worthy of note that on no farm is the quantity of supplementary food at a particularly high level, ranging to a maximum of only 1 lb. per pound of meat produced. That the use of from 50 lb. to 100 lb. of meal per 100 lb. of flesh is profitable is also in accord with the results of meal-feeding trials of the club, which indicate from ½ lb. to 1 lb. of meal per 100 lb. live-weight per day to be profitable in fattening at average prices for meals and for pork and bacon.

It should also be noted that on farms using meals to supplement separated milk it was not the general policy to use them right through from birth to slaughter; rather was their use confined to the feeding of (*a*) the nursing-sow, (*b*) the sucker during the pre-weaning stage, (*c*) the weaner for a few weeks after weaning, and (*d*) the fattening pig only when milk-supplies were inadequate. On farms wintering store pigs meals were also used during this stage. It is suggested that the use of the meals in this way—essentially during the early rather than the later stages of growth, and also during periods of milk-shortage—was a contributing factor to the success obtained on the profit side. Controlled investigations into the problem of the economic use of meals, as well as theoretical considerations, show that these relatively expensive foods will return a greater profit when used during the early stage of growth, for the reason that as the pig increases in weight more food is required to produce a pound of weight gain.

Practically every farm used roots of one or more varieties—mangels carrots, swedes, potatoes—to supplement the rations of sows and other pigs during the winter period. It is impossible, however, to estimate accurately the quantities so employed. In addition, grass provided the bulk of the dry sows ration on most farms, while the young pigs also had access to pasture during part of their fattening period. The adequate provision of supplements of these types was a characteristic feature of farms securing the best returns.

THE INFLUENCE OF TYPE OF TRADE.

In view of the possibility of future expansion of pig products being of necessity along lines of bacon-production rather than of pork-production, it is desirable that more definite information should be available upon all aspects of these two types of trade.

At the present time the majority of farmers concentrate upon pork-production, using a limited output of pigs of bacon weight to cope more effectively with the seasonal fluctuations in their milk-supplies. This situation is illustrated in Table 3 from the average results, more pork and light weaner store pigs being produced than baconers by the farms under examination. Actually only six farms of the fifty-four produced over 75 per cent. of the total output in the form of bacon carcasses.

From the point of view of efficiency of production, theoretical considerations, as mentioned in the first report(1), suggest that there should be little difference between porker-production on the one hand and baconer trade on the other so far as relative output per 100 lb. of butterfat is concerned. The heavier food-requirement per pound of flesh produced after the porker stage is compensated for by the heavier sow overhead of porker-production. It is equally evident, however, due to the seasonal nature of milk-supplies and the usual farrowing months of breeding-sows, that porker-production is an easier task than baconer-production from the point of view of general management. Late litters meet a falling milk-supply, while it is difficult to fatten any of the second litters born in the summer-autumn period to the bacon stage without considerable reliance upon supplementary feed. It is undoubtedly for this reason that many of the farms in this survey fail to farrow all their sows twice annually, farrowing only a proportion during the summer-autumn period.

So far as the farms covered in this survey are concerned, the following table sets out the position according to the level of bacon-production :—

Table 6.—Productive Efficiency : Type of Trade.

Group : According to Percentage of Bacon produced.	Number of Farms.	Average Flesh per 100 lb. of Butterfat.	Range of Flesh per 100 lb. of Butterfat.	Sow-Cow Ratio.	Pigs reared per Sow.	Meal per 100 lb. of Flesh.	*Cash returns per Pound of Butterfat.	
							Gross.	Net.
		lb.	lb.	1 :		lb.	d.	d.
Nil ..	10	44·4	69–37	7·8	13·7	37	1·78	1·60
1 to 25 ..	7	45·7	72–23	8·3	13·0	42	1·83	1·62
25 to 50 ..	19	42·6	56–33	8·2	12·8	20	1·70	1·61
50 to 75 ..	11	38·1	52–23	12·0	10·6	39	1·52	1·36
75 to 100 ..	6	35·9	52–22	12·0	8·9	50	1·44	1·25

* The cash returns are based on the same price for pork and bacon—4d. per pound. During the period covered pork prices have been invariably higher by 1d. per pound than bacon, a fact which makes the situation even more in favour of the pork trade.

From Table 6 it seems that there is little significant difference between farms producing from nil to 50 per cent. of bacon so far as efficiency per 100 lb. of butterfat is concerned. Even in the case of farms producing over 50 per cent. bacon, there is little difference, though what does exist is in favour of pork-production. Examination of the column showing the pigs reared per sow in conjunction with the production per 100 lb. of butterfat would suggest that part at least of the lower production of the bacon-producing groups in comparison with the pork-producing ones is due to inferior sow-management rather than to the bacon-production itself.

In this latter connection a comparison between the proportion of sows farrowed only once a year in the pork groups and the bacon groups is of interest. In the groups producing from 0 per cent. to 50 per cent. bacon only 3 per cent. of sows farrow only once annually, while in the groups producing from 50 per cent. to 100 per cent. bacon 26 per cent. farrow once only. This largely accounts for the low number of pigs reared per sow.

If, as suggested in the introduction to this section, the policy of failing to farrow a proportion of the breeding-sows during the summer-autumn period is a characteristic of present methods of bacon-producing farms, then the lower efficiency of sow-management on such farms cannot legitimately be advanced as a reason for the lower output of such farms, and the lower production figures shown by the bacon groups must be considered characteristic under present conditions of management. The position calls for investigation of the most efficient farrowing-times for breeding-sows producing pigs for bacon-production.

The figures supply more definite evidence than hitherto available upon which to base recommendations in respect to desirable ratio of sows to cows for the two types of trade. Thus examination of Table 4A and Table 4B would suggest that, under good management conditions in other respects, a ratio of 1 sow to 5 to 7 dairy cows is suitable for high yields under a predominantly pork type of trade, and 1 sow to 10 to 12 cows under a predominantly bacon type of trade.

The Importance of Home Breeding.

If the average standard of efficiency of 40 lb. of pig-meat per 100 lb. of butterfat obtained by the fifty-four farms under review can be considered a better performance than the average, the manner in which the pigs used for fattening were obtained is worthy of attention, in view of the alternative methods of home breeding and buying-in available to all farmers.

Table 1 suggests that high results are obtained in association with the avoidance of buying-in. In examining the records of the individual farms it is perhaps significant that 62 per cent. reared all the pigs they required for fattening, 50 per cent. reared more than they required as shown by the number sold as weaners to be fattened by other farmers, 38 per cent. bred insufficient animals and were forced to purchase part of their requirements, while only 16 per cent. purchased more than 10 per cent. of the number of pigs they sold.

Of the latter, the following table shows the relative production :—

Table 7.—Production of Farms purchasing 10 per Cent. and upwards of their Requirements of Pig Numbers.

Number of Farms.	Percentage of Purchased Pigs.	Yield per 100 lb. of Butterfat.	Sow-Cow Ratio.	Pigs reared per Sow.
		lb.		
4	20	33·1	1 : 9·7	9·0
6	40	30·0	1 : 12·0	7·6

Carrying a wide ratio of sows to cows, combined with poor sow-management, these farms have been forced to buy pigs to cope with milk-supplies. From observation of the methods of such farms several factors in part or together contribute to the generally lower level of efficiency :—

(*a*) Purchased pigs frequently bring disease which affects not only the thrift of the bought-in animals, but very often that of the home-bred pigs as well.

(*b*) Owing to the price factor, purchases are seldom made when actually required according to milk-supplies, and the number handled frequently falls below that possible. The net result is a wastage of separated milk.

(*c*) Economy of food-consumption decreases with increase in the size of the pig. The purchasing farmer loses the economy of the weaner stage, and, in addition, frequently makes matters worse by growing his purchased animals to very heavy weights in order to recover his original cash outlay.

(*d*) On such farms the farmer regards the pig more as a means of eliminating a waste product—skim milk—rather than as a profitable source of revenue. This attitude is reflected in general management methods with resultant effect upon production.

In reference to the first point, that of disease, the experience of three farms, whose low results of 28·3 lb., 22·9 lb., and 21·5 lb. are definitely attributable largely to losses through disease, may be mentioned in illustration. These farms purchased 47 per cent., 42 per cent., and 25 per cent. of their requirements of pigs respectively. Disease of a parasitic nature was introduced, and as a

result up to 25 per cent. of the purchased animals died, the rate of growth and grading quality of the remainder was affected, and the trouble was transmitted to the home-bred pigs as well.

The Influence of Month of Farrowing of Breeding-sows.

Since pig-raising in association with dairying involves efficient utilization of separated milk, and since supplies of this food which forms and must continue to form the bulk of the ration are seasonal in nature, it is obvious that really efficient utilization requires a planned adjustment of pig numbers and sizes to milk-supplies. Such a balance between milk-supplies and food-requirements of the pigs necessitates in its turn the organization of sow-farrowing to produce pigs in the numbers and at the times required.

Previous examination of this aspect of pig-management by the writers suggest that early farrowing, commencing before the herd comes into profit, and a distributed farrowing, extending over two or three months, is likely to give the best results. Particularly is this important, for reasons already given, in respect to bacon-production.

During the 1934–35 season an endeavour was made to collect data of farrow dates. This was successful in the case of twelve farms, all producing at a good level of efficiency and all producing mostly pork. While the number is insufficient upon which to base any conclusions, the results are of interest in lending support to the suggestion that early farrowing and planned farrowing are helpful to good results :—

Four farms farrowing—
First litters May, June, July
Second litters Nov., Dec., Jan. } Averaged 55·2 lb. of flesh per 100 lb. butterfat.

Four farms farrowing—
First litters July, Aug., Sept.
Second litters Jan., Feb., Mar. } Averaged 48·8 lb. of flesh per 100 lb. butterfat.

Four farms farrowing—
First litters Aug., Sept., Oct.
Second litters Jan., Feb., Mar. } Averaged 43·5 lb. of flesh per 100 lb. butterfat.

Other General Management Factors.

While the data available are insufficient to obtain information upon more detailed aspects of management for the reasons already given, the opinion of the recording officer, based upon close observation of the farms concerned and a wide practical experience of pig-raising under dairying conditions, is worthy of attention. In addition to the points already mentioned, he considers the following factors to have played a part in the general high average of the fifty-four farms as a whole, and of the extremely satisfactory figures of the more efficient units :—

(*a*) Good-quality breeding-stock : Many of the breeding-sows have themselves been under the test of official litter-recording, and many others have been selected on a basis of litter-recording work from proven strains.

(*b*) A definite policy on the part of the farmer in respect to all his pig operations.

(*c*) Consistent and regular feeding from birth to slaughter.
(*d*) The marketing of pigs at definite weights, rather than marketing when milk-supplies suit.
(*e*) Reasonable housing and equipment, providing warmth and comfort for both breeding-stock and growing pigs at all times.
(*f*) The reduction of mortality to a minimum by reasonable care of the sow at farrowing-time, reasonable cleanliness in quarters and in feeding-equipment, and other simple precautions.

SUMMARY.

The foregoing presents an outline of the results obtained from the survey of pig-production on Manawatu dairy-farms, and indicates—

(1) That a standard of 40 lb. of pig-flesh per 100 lb. of butterfat is obtainable from pig-raising on home-separation dairy-farms under reasonable management conditions.
(2) That this can be secured with reasonable management by running a ratio of 1 breeding-sow to 5 to 7 dairy cows when pork is the major product, and 1 sow to 10 to 12 cows when bacon is the major product.
(3) That fourteen pigs per sow should be reared annually for really efficient results; a high sow-cow ratio together with efficient sow-management is essential for high yields.
(4) That the use of supplementary meals along with separated milk is helpful in the securing of high yields, and such use is economic when combined with good management: at the rate of from ½ lb. to 1 lb. of meal per pound of meat produced.
(5) That there is little difference on an efficiency basis between pork and bacon production; pork-production gives slightly better results under present methods of production; pork-production combined with a proportion of bacon-production offers greater ease of management than either alone.
(6) That home-breeding is associated with more efficient results than purchasing.
(7) That a planned policy of farrowing-periods for breeding-stock is a characteristic of the policy of the most efficient farms; that early farrowing rather than late seems associated with high yields.

The data contained in the foregoing report was collected by Mr. W. J. Croucher, formerly recording officer of the club. Thanks are due to Mr. E. P. Nielsen, present recording officer, for assistance in the classification of the data, and to Professor Riddet for advice and criticism in the preparation of this paper. The thanks of the club are also due to the many farmers who readily made their farms, their books, and records available to the club, and to the New Zealand Meat Producers' Board, whose financial assistance to the club has made the work possible.

REFERENCE.

(1) RIDDET and MCMEEKAN: Returns from Pig-fattening on Dairy-farms. *N.Z. Jour. Agr.*, February, 1934.

PREVENTION OF STORAGE WASTAGE IN COX'S ORANGE PIPPIN APPLES.

RESULTS OF COLD-STORAGE INVESTIGATIONS.

R. SUTHERLAND, Cool Storage Officer, Horticulture Division, Department of Agriculture, Wellington.

DURING the past four years (1932–35) a series of investigations into the cause of wastage in Cox's Orange Pippin apples was carried out in co-operation with the Department of Scientific and Industrial Research and the New Zealand Fruit-export Control Board.

The definition of the word "wastage" used in this report means deterioration which renders apples inedible, causes loss, or reduces their market value.

As almost every season some loss in Cox's Orange Pippin apples from bitter-pit, internal breakdown, and fungal rotting is reported in shipments at their destination overseas, a series of experiments was designed to test the influence on these diseases of a number of factors obtaining in the export of this variety of apple. The examinations of the fruit were arranged in such a manner as to reproduce conditions comparable with shipment, transport, and distribution of the apples at their respective destinations in the United Kingdom.

The apples concerned in the trials were obtained from orchardists engaged in the export trade; the fruit was wrapped, packed, and forwarded to cold storage at Wellington through the usual channels as for export. The examinations of the experimental fruit were made each season at times coinciding with the arrival of a shipment of Cox's Orange Pippins at an overseas destination and subsequent marketing.

In this manner the influence of the following factors on the incidence of wastage was tested, and the results obtained will be discussed under their respective headings: (*a*) Locality and soil types; (*b*) maturity at the time of picking; (*c*) transport temperatures; (*d*) wrap treatments; and (*e*) types of packs.

LOCALITY AND SOIL TYPES.

The Cox's Orange Pippins involved in the trial to test the influence on locality and soil types on wastage were obtained from five localities and from two types of soil (clay and sandy) in each locality. The terms "clay" and "sandy" soils applied to them may not in every case possess the characteristics which would be attributed to them in any system of soil classification, and therefore the terms merely indicate the heavy and light soil obtaining in each locality.

For this experiment the samples were taken from the first commercial picking, but complete uniformity was not adopted in gathering the fruit; consequently some of the samples were gathered more forward in maturity than others, the result being less bitter-pit in the more mature fruit at the expense of increased internal breakdown and fungal rotting.

In some instances, however, there was evidence that the stage of maturity at which the samples were gathered was not the sole cause of fungal rotting, and although it is well known that orchard hygiene

is very important in the production of clean fruit, packing-house sanitation is equally as important in preventing fungal rotting. Cleanliness of the packing house and plant is essential. All culls and decayed fruit should be removed from the interior and exterior of the packing-sheds. The machinery, bins, and the floor should be thoroughly cleaned once daily. Earth floors in packing-houses are a source of fungus infection, particularly where decayed fruit has been dropped and has been allowed to be tramped into the soil. The spores may be discharged into the atmosphere, lodge on the fruit, and become active when the conditions are suitable for their germination.

In agreement with the results of the split consignments carried out during the 1928 and 1929 seasons, except for bitter-pit, wastage was negligible at the time the samples were removed from cold storage. It was not until they had been exposed to air at atmospheric temperatures that fungal rotting began to increase to any appreciable amount.

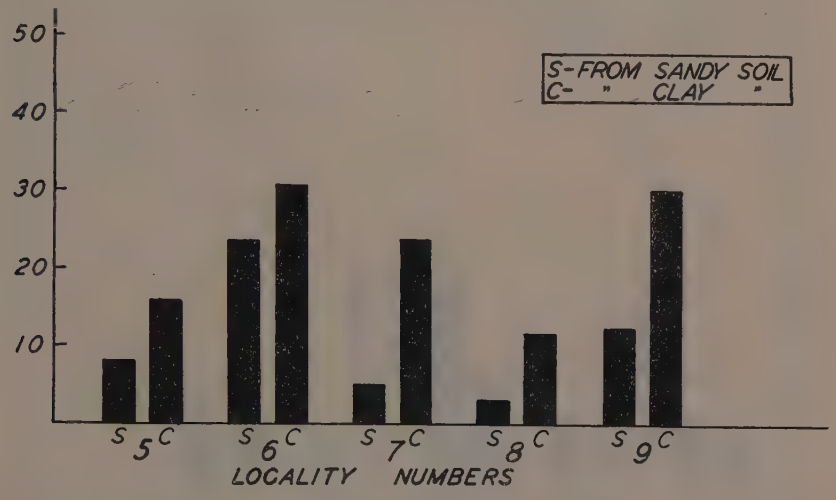

FIG. 1. BITTER-PIT.

Average percentage of bitter-pit in Cox's Orange Pippins for four seasons from five localities and from two soil types.

The influence of locality and soil types on the incidence of wastage is well marked (Figs. 1, 2, and 3), bitter-pit and internal breakdown being more pronounced in the samples grown on clay than on sandy soil in the respective localities, but in variable amounts from all localities from season to season.

The highest percentages of general wastage occurred during the 1933 season, while in the 1935 season's trials bitter-pit was very high in the samples of Cox's Orange Pippins from all localities and soil types,

BITTER-PIT.

Fig. 1 shows the average percentages of the occurrence of bitter-pit over a period of four seasons.

Although the figures for bitter-pit show that Cox's Orange Pippin apples grown on clay soils are more susceptible to the disease than

those grown on sandy loams irrespective of locality influences, it would be difficult with our present knowledge not to conclude that the incidence of the disease is influenced from season to season by orchard conditions. It is more serious in large than in small apples, worse on fruit from young than from old trees, especially if the crop is light in association with heavy rainfall late in the growing-season, and susceptibility is increased if the apples are immature when picked. There is no evidence that cold-storage conditions play any part in the incidence or recovery from the disease.

There is no doubt whatever that bitter-pit is responsible for considerable loss each year, and, as stated by Dr. J. Barker, in spite of the numerous investigations which have been carried out in different parts of the world bitter-pit remains a major source of wastage in certain varieties of apples, and critical information as to causal factors is still lacking. Many theories of the origin of bitter-pit have been advanced, but so far none of these can be accepted as proven.

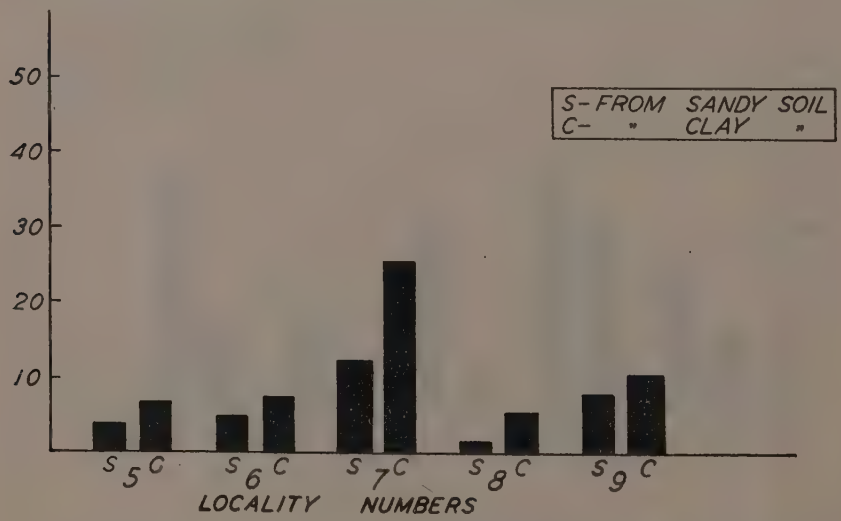

FIG. 2. INTERNAL BREAKDOWN.

Average percentage of internal breakdown in Cox's Orange Pippins for four seasons from five localities and from two soil types.

INTERNAL BREAKDOWN.

As with bitter-pit (although not so extensive), internal breakdown varied with locality, soil types, and seasonable influences. The disease certainly characterizes the end of the storage life of apples. In this experiment the four main types of breakdown which occurred were (1) over-maturity breakdown, (2) bruise breakdown, and (3) breakdown following water-core and bitter-pit. In the former type the apples were soft and mealy, and sometimes the skin of the fruit was cracked; in the second type the flesh surrounding the bruise was soft with a transparent appearance; and in the third type the apples were soft and soggy.

Fig. 2 shows the average percentages for internal breakdown in Cox's Orange Pippin apples from five localities over a period of four years when stored at temperatures of 36° to 38° F.

The data obtained (Fig. 2) indicate a greater liability to internal breakdown in the samples from clay than from sandy loams, and the greatest significance in locality influences appear to occur in locality 7; but a suggestion that the serious development of internal breakdown in the sample was solely due to locality factors may be misleading, as the greater incidence of the disease seemed to be to some extent due to the fruit being in a more advanced stage of maturity than the samples from the other localities, and consequently more liable to breakdown.

FUNGAL ROTTING.

Except in the samples from locality 7, and, to a lesser degree, on the Cox's grown on clay soil from locality 9, fungal rotting, although not actually serious, was sufficiently pronounced to warrant some attention.

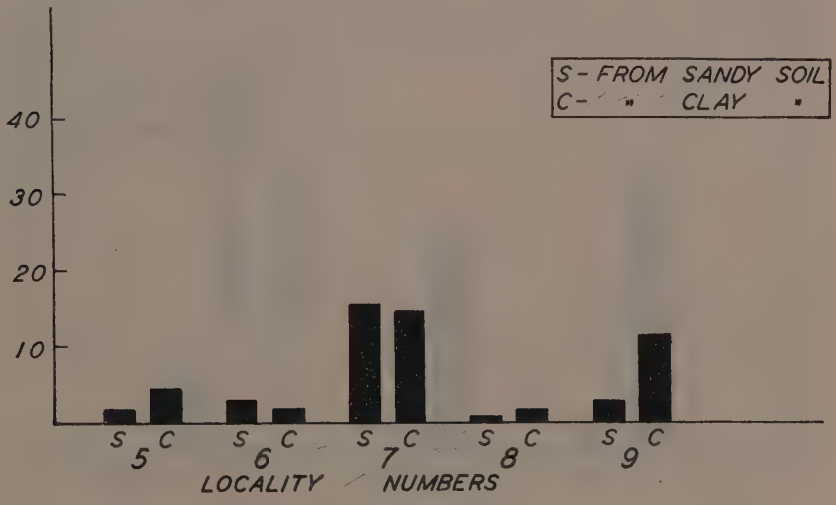

FIG. 3. FUNGAL ROTTING.

Average percentage of fungal rots in Cox's Orange Pippins for four seasons from five localities and from two soil types.

Following on the serious development of internal breakdown in the fruit from locality 7 (Fig. 3), fungal rotting was consistently bad during the period of the experiments, and, as with breakdown, fungal rotting appeared to some extent to be due to the same cause (advanced maturity).

Commercial cold stores were used for the storage of the fruit concerned in the trials. Difficulty was experienced at one shed in obtaining accommodation for holding the samples at air temperatures after removal from cold storage, and on this account the Cox's Orange Pippins from locality 9 had to be subjected to a considerable number of handlings. The evidence appeared to indicate that fungal rotting in these samples was due to post-storage conditions rather than pre-storage or storage factors.

The percentage of the three types of wastage (bitter-pit, internal breakdown, and fungal rotting) shown in Figs. 1, 2, and 3 is merely an average from single plots in two orchards in each locality, and does

not constitute an average for the incidence of the different diseases in Cox's Orange Pippin apples over the whole of any area in any locality.

Maturity at the Time of Picking.

An investigation was carried out to determine the relationship of maturity at the time of picking and the subsequent development of bitter-pit and general wastage (rots and internal breakdown).

As Cox's Orange Pippins are very susceptible to bitter-pit and internal breakdown, comparable samples were gathered at intervals of approximately two weeks at the following stages of development: "Early export maturity," "mid-season maturity," and "late-season maturity." All the conditions as in transport overseas and retail distribution were observed.

Although in all instances (except for bitter-pit) in the early and mid-season samples wastage was slight on removal from storage at temperatures of 37° to 38° F., the "late-season maturity" samples

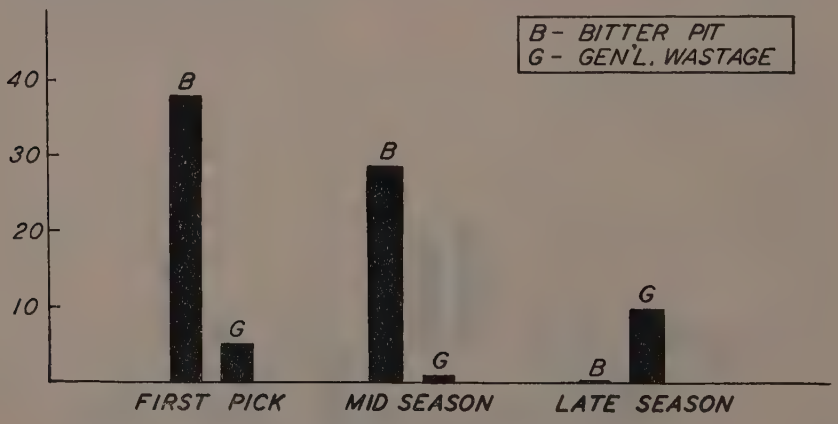

FIG. 4. MATURITY.

Effect of maturity at time of picking Cox's Orange Pippins on the incidence of bitter-pit and general wastage.

were rather more mature than is desirable on the overseas markets, and they showed a greater tendency to develop more wastage than did the less mature fruit (Fig. 4).

The results shown in Fig. 4 reveal a progressive reduction in the amount of bitter-pit and an increase in general wastage the more mature the apples at the time of picking. While the ripe mature samples are not always so free from pit in pit-susceptible seasons, it is appreciably less in its incidence when the apples are allowed to remain on the tree until they are almost fully ripe, but this freedom from pit is offset by an increase in the amount of general wastage.

Transport Temperatures.

In order to collect further evidence of the effect of transport temperatures on internal breakdown in Cox's Orange Pippins, several trials were undertaken with comparable samples—two sizes, 216 and 180, stored at different temperatures, 33° to 35° F., and 36° to 38° F.

During the storage period the temperatures were uniform, and the flesh of the fruit was maintained at 34° and 37° F. respectively. Although the relationship between size and internal breakdown is well known, as might be expected there was very little difference in the amount of wastage in the two sizes—viz., 216 and 180 counts.

The influence of temperatures was, however, significant, and as both samples were free from the disease when they were discharged, the effect of storage or transport temperatures on the development of internal breakdown subsequent to discharge was pronounced (Fig. 5).

Although the ground colour of the skin of the samples held at low temperatures was greener than those stored at the higher temperature, nevertheless the flesh of the latter samples was firmer than that of

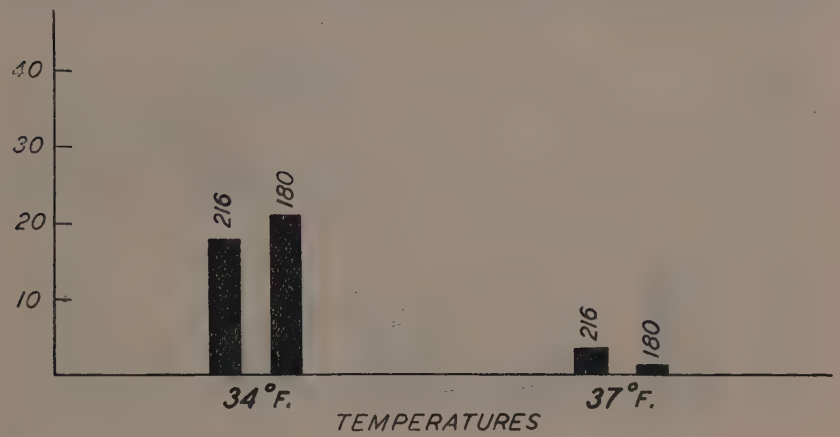

FIG. 5. INTERNAL BREAKDOWN.

Effect of temperatures on the incidence of internal breakdown in Cox's Orange Pippins in relation to sizes.

the former, which showed a distinct discoloration. A close observer with a knowledge of low-temperature breakdown could detect the change in the colour of the fruit, and could therefore anticipate early deterioration as against a greater length of life in comparable fruit from storage at higher temperatures.

In assessing the influence of the various factors on wastage in the Cox's Orange Pippins concerned in the foregoing experiments, it should be taken into account that the apples were reduced rapidly and uniformly maintained at temperatures of 36° to 38° F., and that the percentage of wastage given is the total of the various diseases in all stages of development (slight and significant) after exposure to air at approximately 60° F. for eighteen to twenty-one days subsequent to discharge from cold store.

Packing-pads.

During the transport of apples through the various channels in transit from packing-shed to the markets, fruit receives numerous handlings of a varying nature, and, in order to reduce the possibility of damage and the consequent development of fungal rotting, different types of packing-pads have been introduced, foremost amongst these being the one-piece

corrugated wraps. To test the relative merits of this wrap in preventing damage, a number of trials were arranged in which the corrugated wrap was subjected to comparison with one-piece plain cardboard wraps, corrugated wraps top and bottom of case only, and no packing-pads.

As it was suggested that the more mature the fruit at the time of gathering the greater the liability to bruising during packing and in transit, samples of comparable size were gathered at two stages of maturity (early and late), packed in the respective wraps, and subjected to similar handling and storage to that obtaining in shipments overseas.

In each experiment four cases of apples were involved, and a standard method of examination and classifying the fruits as slightly or severely bruised was adopted.

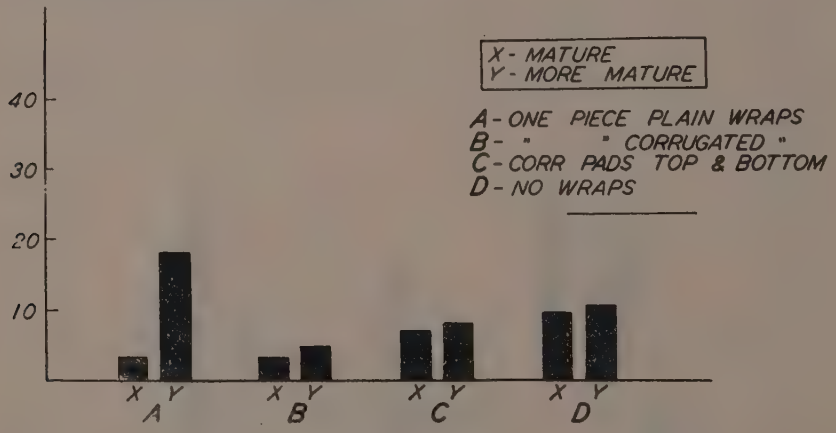

FIG. 6. CONTROL OF BRUISING COX'S ORANGE PIPPINS BY WRAP TREATMENTS, AND THE RELATIONSHIP OF MATURITY AT THE TIME OF PACKING TO BRUISING.

The fruit at the ends, sides, and centre was examined separately, and fruit classed as severely bruised was that to which the trade would take exception, and which would affect its keeping-quality.

The late-picked more mature fruit bruised more severely than the less mature harder fruits. Bruising was more severe in the fruit at the sides of the cases than in the centre. (Fig. 6.)

This result indicates that in the less mature samples more bruising occurred to the fruit in the cases which had no pads or protection on the sides, while in the more mature fruit the amount of significant bruising was greater in the cases with one-piece plain wraps than in the no-wrap treatments. The one-piece corrugated wraps which protect the fruit against all surfaces within the case showed to advantage in diminishing bruising.

Methods of Packing.

Another test in connection with bruising in Cox's Orange Pippin apples was undertaken, in which a comparison was made between two types of packs in one-piece wraps. In one pack the crown was built in the case to give the crown when the pack was finished. In the other the pack was flat above the case, and the lidding-press used to press the apples down at the ends to form the bulge.

In examining these packs the apples were taken out in sections, the two ends and sides and the centre separated. The fruits in the centre of the flat-packed case showed more significant bruising than those at the sides and ends of the case, and where the crown pack was adopted the amount of bruised fruits was markedly less, the difference being 3 to 1 in favour of the crown pack.

Summary of Conclusions.

(1) Cox's Orange Pippins from sandy (light) loams are less susceptible to bitter-pit and internal breakdown than comparable apples from clay soils (heavy loams). (Figs. 1 and 2.)

(2) Bitter-pit varies in its incidence with locality influences. (Fig. 1.)

(3) Bitter-pit is greater in its incidence in Cox's Orange Pippins gathered immature, and the disease becomes progressively less the more mature the apples are when they are gathered from the tree. (Fig. 4.)

(4) Susceptibility to internal breakdown and fungal rotting is more pronounced in Cox's Orange Pippins picked more mature late in the season. (Fig. 4.)

(5) Internal breakdown in Cox's Orange Pippin apples is appreciably reduced by storage at a relatively high temperature of 37° F. as against a lower temperature of 34° F. (Fig. 5.)

(6) One-piece corrugated wraps used for lining cases in the packing of apples offers the maximum protection against bruising. (Fig. 6.)

(7) Mature, ripe apples are more liable to bruise than less mature fruit irrespective of wrap treatments.

(8) Apples packed with a crown to the shape of the bulge are less bruised than when finished to a flat surface, and the lidding-press used to press the apples into position to form the bulge at the top and bottom of the case.

EVERSION OF THE VAGINA IN EWES.

A. Bayly, T. H. Hankin, and P. Haugh, Veterinarians at Wanganui, Masterton, and Gisborne.

Eversion of the vagina in ewes was more prevalent than usual during last lambing period, and the opportunity was taken in the Wairarapa, Rangitikei, and Poverty Bay areas to make further observations on certain aspects of the problem. Before summarizing the information that was obtained it will be as well to review briefly the available reports on the subject.

Previous Records.

The most complete account of it was given by Gilruth (*N.Z. Dept. Agric. Bull. 73*) whose views may be summed up as follows: The eversion occurs suddenly and almost invariably within a week or fortnight before lambing. In most cases the ewe is carrying twin lambs, or, if only one lamb is present, it is an unusually large one. She is in gross condition, or may have an excessive quantity of fat in the adominal cavity, although not externally. Feed is plentiful, and this, together with the natural tendency of a heavy ewe in advanced pregnancy, leads to her taking the minimum of exercise. The tendency is to lie down for

long periods, and while doing so the bladder becomes distended with urine to a degree that difficulty is found in urinating when she eventually rises to her feet. Straining is thus induced, "the result of which would be the forcing of the gravid womb back partly over the bladder into the pelvic cavity, and if the pressure were continued—as it would be—it would result in the forcing out of the vaginal membrane." The bladder and the uterus would then pass back into the pelvic cavity, and the pressure would still further prevent the escape of urine. Assuming that this explained the onset of eversion, daily exercise was recommended, the sheep being "roused up" occasionally each day, so as to ensure proper evacuation of the bladder, and it is claimed that where the advice was thoroughly adopted results were excellent. The curative treatment recommended was to cleanse the everted organ and replace it, administering a sedative in the form of laudanum to counteract straining, and a dose of oil or Epsom salts to ensure emptying of the bowels. The orifice could be stitched with tape or locks of wool could be tied across it from either side to assist in preventing a recurrence of the eversion.

On many occasions since Gilruth's time in New Zealand reports on the occurrence of this condition have been obtained from field officers of the Live-stock Division and, in general, they agree as to the circumstances under which it is encountered. There seems to be no doubt that it is prevalent in seasons when climatic conditions in the autumn and early winter have been such as to provide feed in unusual abundance, yet it would seem that there may be more involved than merely gross condition, a high percentage of twins, and a lack of exercise. Or possibly one should say that these three factors are not *essential* for the occurrence of eversion—it may occur under other conditions as well.

Outbreaks occurring under Unusual Feed Conditions.

In an official report on this subject, dated October, 1925, Mr. W. C. Barry, M.R.C.V.S. (now Director of the Live-stock Division), states: "My own opinion is that the trouble is not always due to an overfat condition of the ewes at lambing, as I have seen it in ewes which could not be considered fat and were grazing on poor country."

Some reports that have reached the Department from its own officers suggest that the heavy, fibrous overgrowth of the pastures present in winters that follow a particularly good autumn growth may have a bearing on the subject, and Mr. A. Leslie, F.R.C.V.S., late of Lincoln College, states in a personal communication that in Canterbury a diet containing excess of fibre, such as wheat straw or pea straw, is a common predisposing cause. He has also observed the condition after prolonged turnip feeding with no supplementary feed, and when poorly fed ewes are suddenly transferred to good feed.

There may easily be visualized in these cases a condition in which the tissues are flaccid and lacking in tone, which may tend towards the occurrence of eversion just as readily as would an overfat condition, particularly as the diet would involve distention of the rumen, and so increase the pressure within the abdominal cavity.

There are some unusual features associated with the occurrence of this disease in the Marlborough South coast area. From information given by Mr. D. S. A. Weir, Inspector of Stock at Blenheim, it appears

that some years ago eversion was a rare occurrence, but during the five years preceding the autumn of 1935 abnormally dry seasons occurred, and during that time the condition increased till the losses on several farms were considerable. The five dry years changed the type of pasture from rye-grass, cocksfoot, and clover mixtures to mainly danthonia. That is to say, the condition became more prevalent as the pasture deteriorated—which is the reverse of the usual happening. Good rains since 1935 have restored the pastures and improved the feed to a very striking degree, and yet this past lambing, which was an excellent one, saw a comparative absence of eversion cases. Merino-Romney crossbred sheep predominate in the affected area, and, while it is obvious that the circumstances in which the disease occurred differed from the usual, it is felt that certain factors other than the common ones were involved—these may be elucidated when the opportunity for further observations occurs.

Eversion occurring after Lambing.

Another feature of this condition, however, which is difficult to explain is the fact that cases undoubtedly occur in ewes that have been lambed for a considerable period. In the Marlborough South coast area there have been many instances wherein about half the cases occurred a few days before lambing and the others at various times from after lambing up to shearing time (roughly from September to January). An instance has been reported by Mr. C. V. Dayus, M.R.C.V.S., of Dunedin, in which the condition occurred in February among some ewes that had lambed normally the previous October. They were sheep of a large roomy type, and were on irrigated pasture in which clovers predominated, so that rich and succulent feed was available to them with no effort.

There is no evidence whatever that the condition is in any way infectious or contagious.

The Present Inquiry.

When inquiries were instituted in our respective districts last year it was thought desirable, as a commencement, to concentrate attention on certain points and to collect information about them from a series of farmers in each district. This was duly done, and a mass of information was obtained from a total of nineteen farms, which it is possible only to summarize very briefly here. The points on which inquiry was made and the summarized information obtained on each may be set out seriatim :—

What was the incidence of affected ewes in the flock ?—On the nineteen farms the incidence was—On five farms 1 per cent., on three 2 per cent., on five 3 per cent., on three 4 per cent., on one 5 per cent., on one 7 per cent., and on one 8 per cent.

What were the feed conditions during autumn and winter, and of the flock prior to lambing, and have climatic factors any influence ?—In every case feed had been exceptionally good, and the ewes approached lambing in high condition. Several farmers commented that there had been an almost spring like growth practically throughout the winter, and that the ewes were putting on condition all the time.

As to climatic factors influencing the actual occurrence of eversion, it is believed by some farmers that the trouble occurs mostly in cold weather, and that close crutching makes the ewes more susceptible to it. One owner stated that when his stud Southdowns were machine crutched a number were affected with eversion each year, but for the past few seasons he has merely trimmed them lightly with hand shears and the trouble has practically ceased. Another farmer stated that during one exceptionally frosty season his own ewes, which were machine crutched, were severely affected whereas similar but uncrutched ewes on adjoining paddocks were unaffected. Further inquiries on this point will be instituted.

The age and type of affected ewes.—The condition was more frequently met with in mature and aged sheep than in younger ones, but in not a few cases losses occurred among maiden ewes and 6-tooths as well. The flocks investigated were Romneys, Southdowns, Romney-Lincolns, and Romney-Southdowns, and, given similar conditions, there seemed nothing to chose between them. Some owners considered that the "roomier," more "stockily built" type of ewe was more prone to evert her vagina. In this connection it is of interest to record that the Marlborough South coast area farmers stated that the disease was not found in the pure Merino, but occurred in the half-breds and three-quarter breds which are "roomier" than the pure Merino. One or two owners in that locality stated that the incidence increased after they had used Romney rams, and had thus bred a broader type of ewe, and decreased again when they went back towards the pure Merino type of body.

What was the proportion of affected ewes carrying twin lambs?—In one case the affected ewes were mostly carrying single lambs and in three others about 50 per cent. were twin pregnancies. In the other fifteen cases twin pregnancies accounted for from 75 per cent. to 95 per cent. of the incidence.

When the size of the lamb was inquired into in cases where ewes with singles were affected, it was considered in six cases that they were generally unusually large, but in most cases particular notice had not been taken on this point. It was observed by several farmers that, in general, all the lambs on their farms this season were large and strong at birth (which confirms the good feed that had been available to the ewes during pregnancy).

What was the influence (if any) of the use of salt or other mineral licks on the incidence of the disease?—So far as the information went the use of rock salt, various salt licks, and of certain proprietary mineral mixtures appeared to have no effect on the incidence of eversion of the vagina. As one example one might refer to the fact that the heaviest incidence noted—viz., 8 per cent.—occurred on a farm where rock salt is permanently available to sheep in all paddocks, and the next heaviest—viz., 7 per cent.—on a farm where no licks nor top-dressing had been used at all.

What was the incidence of antepartum paralysis (sleeping sickness) compared with that of eversion of the vagina?—The reason for inquiries on this point was that antepartum paralysis is now considered to occur principally when ewes are falling off in condition as lambing approaches, or when high-conditioned ewes receive a check or set back in condition

at this time, whereas eversion is usually associated with ample feed. Hence in a season when eversion is common antepartum paralysis should (other things being equal) be relatively uncommon.

On sixteen of the nineteen farms where eversion of the vagina was prevalent the incidence of antepartum paralysis was nil or negligible. Special mention must be made of the remaining three farms.

The natural tendency for the farmer who sees eversion cases among his sheep and associates it with an overfat condition is to starve the ewes—but that is a most dangerous procedure, since fat ewes in advanced pregnancy that are given a check in that way are very likely to develop antepartum paralysis. The following are instances of this on the three farms in question: (A) Attempted to force a mob of ewes that were near lambing to eat silage. They were unaccustomed to this feed and refused it for some days. Thirty of them died from antepartum paralysis. (B) Became alarmed when eversion cases appeared. Thinking to reduce their high condition he crammed all his ewes on to a 6-acre paddock for two days, then put them on to other paddocks at the rate of four to the acre and, in addition, drove them several miles a day along the road. Within a few days twelve died of antepartum paralysis. He then spread the ewes over their original paddocks and left them alone. Cases of antepartum paralysis ceased to occur but eversion continued as before. (C) Put seven hundred ewes in an 80-acre paddock about a month before lambing, and kept them there for a fortnight. Nine died of antepartum paralysis. The paddock was then spelled for only a week when he put four hundred ewes in it and drafted them out as they lambed. Eleven of these died of antepartum paralysis. These cases should prove a sufficient warning to farmers of the danger of flying from one extreme to the other.

What preventive measures were tried and with what result?—On eleven of the farms no attempt was made to prevent the condition. Others took various measures, which were scarcely likely to be very effective, as follows: (A) Went the rounds twice daily and "roused up" any ewes that were lying down. (B) Put the ewes in small paddocks and changed at short intervals. (C) Exercised ewes spasmodically and moved them from a higher to a lower paddock according to the weather. (D) Put ewes in a fresh paddock when lambing about to begin—to induce restlessness. (E) Crammed ewes on to a small paddock to lamb (dangerous as well as useless).

One farmer took considerable trouble in an effort to prevent these losses, as he was a heavy loser on a previous occasion and anticipated trouble this year owing to plentiful feed. He was unsuccessful, and it will be as well to give particulars in his case and to consider why he may have failed. He had 2,000-odd ewes, due to lamb on and after 20th August. From 21st June to 1st August he changed paddocks at 3-day to 5-day intervals. On 1st August some 500 early lambers were placed on a good paddock, and moved round it *every second day*. Another 400 ewes were added to the paddock on 10th August, and on 14th August the first case of eversion occurred. By 23rd August there had been thirteen ewes affected. Thus under these conditions there were thirteen cases in ten days among 900 ewes.

He then moved 500 of them to a 20-acre paddock of inferior grasses (sweet vernal and Yorkshire fog, &c.), moved them about

in it twice daily, and drafted out those which lambed. Under these conditions there were seven cases in five days among 500 ewes (approximately the same rate as before). Moreover, the mob was going back in condition, becoming sluggish, and antepartum paralysis began to occur. He therefore moved the remainder of the 500 to a better paddock. There was one case the following day, then none for three days, after which they commenced again. He then put them back on the poor 20-acre paddock for three days and had no more cases.

His experience of the disease can be divided into two periods—from 1st to 23rd August, during the latter portion of which he had thirteen cases, and from 23rd August to early September, during which about as many more were affected, In the former he had crowded the sheep on a good paddock. They were already in heavy condition, and near lambing, and under these conditions would take even less exercise than before. His moving them about the paddock every other day would be unlikely to confer any benefit whatever at that stage. In the later period many of the ewes must have been very near lambing, and they were crammed up closer than ever on a much poorer paddock. The result would be that many of them would take practically no voluntary exercise. The feed not being sufficiently tempting, and there being so many of them to the acre, the heavier ewes would lie down rather than bother in the unequal struggle, and apart from the stirring up they received twice daily, would probably spend most of their time in the lying position. With these points in mind it seems clear that he could hardly expect better results than were obtained.

Compare this case with the final one of the series—the only one of the nineteen men who took successful preventive measures. It is his practice, when the first case of eversion occurs, to drive the ewes about a mile night and morning, giving them an hour on a root crop before travelling back to the paddock, and in the lots which he can handle in this way the condition is well controlled.

What curative measures were tried by the farmer and with what result?—The treatment applied is to cleanse the part and return it into position. Some apply various agents such as weak vinegar as an astringent, or olive-oil as a lubricant, but in most cases the everted portion is merely cleansed, disinfected, and pushed back, and the wool tied across from side to side, or stitches, safety-pins, &c., put across the orifice. A number of the farmers placed affected ewes in the wool-shed for a few days, letting them out for an hour or two of grazing during the day. The results of this rather perfunctory treatment varied from about 15 per cent. to 90 per cent. successful, but it is difficult to give any sound estimate of its results since in many cases where seemingly very good results were obtained it was found on inquiry that only the most favourable cases were treated at all, the rest being killed. Then, again, the result depends on how closely the flock is shepherded, since the success of any line of treatment in this condition will obviously depend on how soon the matter is dealt with after eversion has occurred.

What were the results of post-mortem *examinations of affected ewes?*—Only on a few occasions were such examinations possible, but these confirmed the fact that the only abnormality concerns the eversion of the vagina. Considerable congestion is seen and there are often blood-clots about the neck of the bladder, but such lesions naturally result from the disturbance of the circulation consequent upon the eversion. Constipation was not a feature of the cases examined in this way.

In this connection it should be said that while it is a common belief among farmers that there are two forms of this disease, they are, in fact, merely different degrees of the same condition. The form it takes depends to a great extent on the time at which it occurs. If it takes place about a fortnight before lambing the eversion is usually long and sausage-shaped. There is not complete obstruction to the passing of urine, at any rate at first, and if taken early this type can be treated with a good prospect of success. The eversion which occurs closer to lambing than this is rounder and more swollen in shape. There is complete blockage of the urinary passage, the bladder quickly becomes acutely distended, and this increases the size of the everted portion besides making it impossible to return unless the urine is first drawn off. Cases of this sort are much more difficult to treat successfully than the former, and from *post-mortem* examinations on ewes that have died of this form of eversion it is seen that the seriousness of the cases is due to the stoppage of urine having caused serious back pressure on the kidneys. Such cases often die quite quickly as a result of this, being poisoned by their own excretion, which they are unable to void.

What information can be obtained regarding cases of eversion which occur at times other than just before or just after lambing?—Reference to these was made at the commencement of this report. They are found especially at shearing-time. Inquiry was naturally directed first at discovering whether such ewes were ones which had been affected at, or prior to, lambing, and in cases where definite information could be obtained it showed that this was so in the majority of cases.

On three farms, for instance, there was a total of twenty cases found at shearing-time, and all were marked ewes that had been affected at lambing. In other cases it was thought that the same applied, but as the ewes affected at lambing had not been marked there was no means of discovering the truth. One farmer had a few cases among recovered ewes when he yarded them about a fortnight after lambing. Another, who had several cases of eversion before lambing, and managed to save only a few of them, claimed that the number of cases found between lambing and shearing exceeded the number that he saved at lambing-time. Unfortunately, he had kept no records, nor were the ewes affected at lambing marked in any way, so that there must be some doubt as to the extent to which his impressions were correst. However, one report from Poverty Bay stated that odd cases occur each year on that property in hoggets. Reference was made earlier to the occurrence of cases long after lambing in the Marlborough South coast district, and as some of the farmers supplying the information were in the habit of slaughtering

all ewes that became affected prior to lambing, without attempting to save any, the after-lambing cases must necessarily have been fresh occurrences. Mr. Dayus's cases had also lambed normally.

It is said that in the cases occurring after lambing, as with those at the more usual time, there are two forms of eversion—viz., (1) A cone-shaped protrusion about 6 in. in length and about 2 in. in diameter. This protusion includes in it the prolapsed uterus, the mouth of which can be found just inside the hinder end of the cone. (2) A smaller, rounder protusion which is composed of the everted hinder portion of the vagina only. In cases of either type that are found at shearing there is generally evidence that the condition has existed for some considerable time, as the everted portion (which is seldom actually inflamed unless it has been damaged by the ewes' movements during yarding) is tending to become fibrous and toughened. Such ewes have usually lost condition and are killed for the dogs, as treatment in old-standing cases of this type is not hopeful. When the after-lambing eversion is found at the time of its occurrence the usual treatment by cleansing, returning, suturing, &c., is generally successful.

The prevailing opinion, which the observations related above tend to support, is that at least a very large proportion of the cases found at shearing are among ewes that were affected prior to lambing. These are readily understandable, as once the part has been everted the stretching and relaxation of the attachments that is involved will naturally make a further similar occurrence so much the easier.

There remain those cases in ewes, and sometimes in hoggets, that cannot be associated with any previous occurrence, and meantime we have not sufficient accurate observations on which to base a sound opinion as to their cause.

Discussion and Conclusions.

The information here summarized resulted from a preliminary survey, and in subsequent seasons it is hoped to continue the work. Meantime, however, there are certain points arising out of facts related above which it should be of value to emphasize, as follows :—

(1) The condition is an important source of loss in certain seasons. The major losses are associated with climatic conditions which produce abundant feed and hence can be, and should be, anticipated.

(2) Preventive measures are not practised as they should be, save in a very few cases. Admittedly there are circumstances in which they are scarcely practicable, but for most farmers some organization and foresight should make it possible to provide the necessary daily exercise and to so regulate the feed as to maintain the sheep in vigorous condition. It is necessary to attend to this well before the time that cases are likely to occur. If nothing is done till trouble begins it is much more difficult to check the loss. The actual eversion is only a symptom of the condition the sheep are in, and that condition must be prevented, not cured. If cases occur, do not take drastic measures that will set the ewes back suddenly, or the consequent loss from antepartum paralysis may be greater than would have occurred from eversion.

(3) As regards treatment, a point to be strongly emphasized is that when eversion occurs in a flock close shepherding must be

adopted. Shepherding once a day is not enough, and is responsible for much of the actual loss from this disease. Cases often occur just after the daily visit and are consequently not found till next day, when the everted organ has become fouled and damaged and the bladder and kidneys seriously injured through inability to void the urine. For successful treatment it is essential to deal with each case as soon as possible after it has occurred, and the only way to do that is to go round the ewes twice or, if possible, three times a day.

As soon as opportunity offers it is intended to carry out some experiments as regards treatment, but in the meantime brief reference may be made to certain essentials. The first thing to do when the affected ewe is caught is to empty the bladder. There is usually no difficulty about this if she is gently placed on her back, as this removes the pressure of the everted organ from the urinary outlet. Occasionally slight manipulation of the everted portion may be necessary to start the flow. Then any dirt should be removed and the part gently cleansed. For this purpose carbolized oil is probably as good as anything, as a bottle of it can readily be carried on the rounds, whereas disinfectants which require water for their use are impracticable for such an occasion. Moreover, the oil softens and soothes the inflamed part and assists in its return. To replace the everted part to its normal position the hind quarters of the animal (still lying on its back) should be raised up, and a little gentle pressure and manipulation will soon succeed. Use the flat of the fingers, as the tips may tear or rupture the delicate membrane that is exposed. Now tie locks of wool across the orifice to prevent a recurrence meanwhile, and take her back to some handy place near the homestead or shed where further treatment can be given if needed and she can be kept under close observation till safely lambed. If sheep so treated are placed in the shed, or a small paddock nearby, they must not be left without attention. They must be properly fed and exercised. One excellent thing to give them each day is about half a pint of linseed-jelly. This is made by half filling a kerosene-tin with linseed and adding enough boiling water to nearly fill the tin. Stir well, cover with a sack, and leave till cold. The jelly so formed is relished by both cattle and sheep and is both nutritious and laxative.

(4) Lastly, it has been very noticeable during this investigation that most farmers fail to mark affected but recovered ewes so that they can later be picked out and culled. That should not be. It is necessary to mark and cull such ewes, because if they do not have a recurrence of the eversion between lambing and shearing they generally do so at the next lambing if the season favours the condition at all. Moreover, there may be some grounds for the belief that it is mainly the ewe that is of a certain stocky type, with a wide pelvis, that is liable to the condition, and if future observations bear this out it will be desirable not only to cull the ewe herself, but her lambs also, since such a type of body conformation is liable to be inherited.

In conclusion, it should be reiterated that the above is an account of field observations of a more or less preliminary nature and that it is hoped, as opportunity offers, to carry out further work on this disease, particularly regarding methods of prevention and treatment. It is also recognized that much more detailed information is needed about the feed conditions and other factors which predispose ewes to it.

LUCERNE.

POLLINATION AND SEED-PRODUCTION.*

J. W. HADFIELD and R. A. CALDER, Agronomy Section, Plant Research Station, Palmerston North.

THE structure of the lucerne flower is such that the pistil and stamens are enclosed in a tense position within the keel. When this tension is released, as may be effected by pressing the point of a pencil into the corolla-tube, the pistil and stamens spring forward causing the pollen to be distributed, and the stigma to strike with some force against the standard, or against any object that is between the stigma and the standard. This process is referred to as "tripping" the flower and allows the pollen to become available for, and the stigma receptive to, pollination. If the pollen of a flower falls on the stigma of the same flower, or on another flower of the same plant, it is said to be self-pollinated. If the pollen from one flower is transferred to the stigma of a flower on another plant it is said to be cross-pollinated. When fertilization is effected by either of these means it is referred to as self-fertilization and cross-fertilization respectively.

TRIPPING IS AN ESSENTIAL PRELIMINARY TO SEED-SETTING.

The majority of investigators agree that a flower will not set seed until it has been tripped. In an investigation at this Station it was shown that for every 100 florets tripped sixty-eight seed-pods were formed, but for every 100 florets not tripped only one or two seed-pods were formed; and, as it is not always possible to be certain whether or not tripping has taken place, it is more than probable that this small percentage was in reality an error of judgment. We may conclude therefore that tripping is essential for seed-production, and that seed-yields will be influenced by the amount of tripping that takes place. In these trials it was possible to double the seed-yield by means of artificial tripping as an aid to natural tripping. Artificial tripping in this case was brought about by rolling the inflorescences between the fingers (Fig. 1).

HOW NATURAL TRIPPING IS EFFECTED.

It is instructive to observe the ways in which tripping is effected. A lighted cigarette tip placed near a flower will cause it to trip. Heat, or perhaps what would be more correctly described as a sudden change in temperature, is therefore an agent bringing about tripping. On a hot dry day the flowers trip very readily, and, if under such conditions they are agitated, or lashed about by the wind, many of them become tripped. The wind is then a second agency. Insects are, however, perhaps the most interesting of the agents, since the shape and structure of the flower appear adapted to the visits of such insects as bees. From this structure it would appear that a bee, when visiting the flower, should push down the corolla-tube in search of nectar and in doing so

* A full account of these investigations has been published in the New Zealand Journal of Science and Technology, Vol. XVII, No. 4. "Lucerne: Investigations relating to Pollination and Seed-production in New Zealand." J. W. Hadfield and R. A. Calder, Plant Research Station, Palmerston North.

FIG. 1. TRIPPING AS AN AID TO SEED-PRODUCTION.

Top left, covered and hand-tripped; top right, covered and not tripped; bottom left, exposed to open pollination and hand-tripped; bottom right, exposed to open pollination and not tripped.

should trip the flower. By tripping the flower in this way the pollen would be dusted on to the underpart of the bee and simultaneously the pistil would strike the bee on the same part, thus receiving on its stigma pollen which the bee had carried there from another flower. In this manner would be effected not only tripping but also cross-pollination. Observations in the field, however, do not support this entirely.

The Honey Bee and Bumble Bee as Flower-tripping Agents.

Honey bees visit the lucerne flowers in large numbers, but very rarely do they effect tripping, and then incidentally while climbing over the flowers in search of nectar. A honey bee normally obtains its nectar by inserting its tongue from the side of the flower. If the flower happens to trip while this is taking place the bee has to withdraw its tongue forcibly, and its consternation is so evident that one must conclude that it is quite unaccustomed to the tripping of flowers.

By maintaining hives within large cages it was proved that the honey bees, black, Italian, hybrid, and Caucasian were all equal in their effects upon seed-production (Fig. 2).

Of the bumble bees, one species (*Bombus terrestris*) pushes boldly into flower after flower with great rapidity, tripping each in what might be termed an orthodox manner. Another bumble bee (*Bombus subterraneans*) is apparently of no use in this respect. It takes its nectar, as does the honey bee, from the side of the flower, and no further reference is made herein to this species.

The bumble bee (*B. terrestris*) has proved to be a very efficient agent in stimulating the setting of seed. For example, by maintaining a bumble bee in a cage enclosing two plants the seed-setting as compared with normal open pollination was raised from sixty-five seeds per 100 florets to one hundred and seventy-six seeds per 100 florets, which is an increase of nearly 300 per cent. (Fig. 3).

In the large bee-cages it was proved that a dozen bumble bees were able to cause more seed to set than about 4,000 honey bees. Unfortunately bumble bees, in this district at least, are insufficient in numbers materially to affect seed-production.

Despite the somewhat unfavourable position in which honey bees are placed when compared with the bumble bee, they are by no means useless. They do trip flowers on occasions and they may be present in such large numbers that collectively they trip as many flowers as do the relatively few bumble bees. For example, within the cages where the honey bees were concentrated in large numbers the seed set there was more than twice the amount that was set outside the cages, so that it is evident that, however inefficient honey bees may be when compared with bumble bees, they can by their very numbers result in a quite considerable increase in seed-production.

Furthermore, they become dusted with pollen as they climb around the flowers, and this pollen they scatter on other flowers, the advantage of which will be discussed later.

Artificial Tripping of Flowers.

Since tripping is essential to seed-production, it seems reasonable to suppose that some implement could be devised which, when drawn over a field of lucerne while in full flower, would cause an increase in

FIG. 2. LUCERNE POLLINATING TRIAL.

Bees of various kinds were maintained in these cages to determine their efficacy as pollinating-agents.

FIG. 3. *Bombus terrestris* AS A POLLINATING-AGENT.

The central branches were caged and one bumble bee maintained within the cage. The outside branches were exposed to open pollination. Note the increased seed-production resulting from the activities of the bumble bee.

tripping, and thus an increase in seed-production. Attempts have been made to devise such an implement without so far attaining much success. At this Station a blast of hot air has been most effective, but an implement devised to bring this principle into effect over a large area would be both cumbersome and expensive. It has already been stated that artificial tripping as an aid to natural tripping has greatly increased the yield of seed at this Station. There is, however, in this connection another matter for consideration—namely, that the artificial tripping of flowers would necessarily result in a high proportion of self-pollination, and it is desirable for this and other reasons to consider the relative effect of self and cross fertilization.

Self-pollination versus Cross-pollination.

Trials have indicated that under normal conditions at this Station far more self-fertilization takes place than cross-fertilization. Therefore the lucerne flower, although apparently constructed to effect cross-pollination, is to a very large extent self-pollinated.

The first observation to be made on the effect of self-pollination is its marked reduction in seed-production when compared with the effect of cross-pollination. Thus, in one typical trial, self-pollination resulted in 53 per cent. of the pods setting seed, the average number of seeds per pod being two. The same plants under cross-pollination resulted in 92·5 per cent. of the pods setting seed, and the pods contained an average of 6·5 seeds. Therefore, under self-pollination there were produced 106 seeds for every 100 florets, and under cross-pollination 601·2 seeds, which is a very substantial increase.

The second observation is that self-fertilization reduces vigour, and that plants raised from seed that has been produced by self-fertilization are far less vigorous, are more susceptible to disease, and yield far less herbage than plants raised from seed which is the result of cross-fertilization.

Therefore the greatest increase in both seed-production and herbage-production is consequent upon cross-fertilization. It is possible to increase seed-production by increased tripping, but such tripping should, if possible, be accompanied by cross-fertilization.

It is reasonable to suppose that in some seasons and in some districts much more cross-pollination will take place than in others, and that an increase in seed-production will follow an increase in cross-pollination. We may infer, therefore, that in these districts and in those seasons in which the greatest seed-yields are obtained are those in which the seed produced is likely to be of the highest value. Conversely, a low yield of seed may reflect, amongst other things, a high degree of self-fertilization, and such seed might be expected to produce a poor crop. These are merely inferences, since the point has not yet been proved. All the evidence points, however, to the importance of cross-pollination, and some of the agencies responsible will now be discussed.

Agencies bringing about Cross-pollination.

From what has been said the bumble bee must be regarded as a very effective agent, and investigations into the possibility of increasing their numbers and introducing new species is worthy of consideration.

An inspection of untripped flowers has revealed lucerne pollen adhering to the flower-standards, so that, if tripping were to take place, some

cross-pollination would be effected. This pollen finds its way on to the standards no doubt through several agencies, one of which is wind. Thus under rather unsatisfactory conditions for wind distribution of pollen, greased slides were suspended above a lucerne crop for twenty-four hours. A microscopic inspection revealed an appreciable amount of pollen adhering to the slides—this pollen must have been blown there by the wind. It has already been pointed out that honey bees also play a part in distributing pollen, and finally the flower itself, when tripped in warm weather, does so with an almost explosive action scattering pollen around.

Conclusion.

While it has been possible to prove that there is ample scope for improvement in the yields of lucerne-seed, it must be acknowledged that no new and practical way has been suggested whereby seed-production might be stimulated, more particularly as a result of cross-pollination. Nevertheless, only by the study and with the knowledge of the circumstances surrounding pollination and seed-production could such suggestions be forthcoming, and the work will not have been in vain if it induces others to take an interest in this problem and make observations in the field.

In the meantime the only recommendation that can be made is that growers should concentrate as many hives of bees as possible in lucerne crops that are being saved for seed.

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SUSPECTED ZINC POISONING IN PIGS.

A POSSIBLE DANGER IN THE USE OF GALVANIZED-IRON PIPING FOR CONVEYING SKIM-MILK TO PIGGERIES.

R. E. R. GRIMMETT and I. G. McINTOSH, Chemical Laboratory, Department of Agriculture, Wellington.

DURING the past twelve months several cases of heavy mortality amongst young pigs and unthriftiness in older pigs, not traceable to infectious disease, have been associated with the installation of new piggeries to which skim-milk has been pumped through galvanized-iron pipes some considerable distance.

In the first case subject to detailed investigation two piggeries had been run in connection with two dairies on the same farm for two years without any trouble among the pigs. These piggeries were situated alongside their respective dairies, with only very short lengths of piping to convey the milk. Early in 1935 a new pipe-line 16 chains long was connected with one dairy and the pigs shifted out on to clean ground at this distance. Numerous deaths occurred among the young pigs shortly afterwards. The pigs comprised about twenty-four suckers on mothers and thirty stores.

During the ensuing winter molasses and water (pumped through the same pipes) was fed to the pigs, very little milk being available, and the remaining pigs did quite well. Seven sows farrowed in the spring.

When milk again became plentiful in the spring and was pumped in quantity through the pipes about forty to fifty pigs died. The symptoms noted were—pigs went off their feed, got up on toes with stilted gait, showed swelling of joints, and lameness, became unthrifty, half-grown pigs failed to grow, young pigs died, while sows (presumably suckling young) were mostly unaffected. During this period the pigs at the other shed (short pipe-line) were unaffected. No evidence of serious infectious disease could be found.

Analysis of organs of a young pig that had died and the milk that it had been fed with gave the following results :—

	Percentage of Zinc on Samples as received.
Stomach contents (mostly material other than milk)	0·0032
Liver	0·044
Spleen	Trace.
Skim-milk that had passed through pipe—	
Liquid portion	0·016
Curd	0·082

The curd contained much liquid, and assuming that about equal proportions of the material represented by each sample was present in the trough, the average of the zinc in the skim-milk would thus be 0·049 per cent., or as zinc oxide, 0·061 per cent., or practically 10 per cent. of the ash of the milk.

The zinc in the liver was more than ten times the amount normally present. Bones from this pig were found to contain 0·074 per cent. of zinc on the ash.

Arsenic, lead, and other poisonous metals which, as possible impurities in the zinc, might have been responsible for the mortality were sought for in all samples with negative results.

Subsequent samples from other pigs confirmed these findings, and on obtaining sections of the pipe-line before and after use it was found that the galvanizing (zinc lining) of the inner surface had been almost entirely removed, being replaced by a thick layer of curdy or cheesy material. Assuming that the zinc removed from the 16 chains of pipe had all gone into the milk and been fed to the pigs, it was estimated that they must have consumed approximately 50 lb. of pure zinc.

After an interval of two months, during which the severity of the trouble diminished considerably, further samples were received, being specimens from a pig that was still ailing. Their content of zinc was as follows :—

	Percentage of Zinc on Samples as received.
Stomach contents	0·004
Heart	Trace.
Liver	0·022
Spleen	Trace.
Intestine and contents	0·004
Lungs	0·0017
Fluid from knee joint	Distinct trace.
Kidney	0·005

Skim-milk passed through the pipe-line now contained 0·0024 per cent. zinc, while milk straight from the separator contained less than 0·0004 per cent. Apparently practically all the zinc had now been removed from the pipe-line, and the pigs were slowly eliminating the zinc from the soft tissues and organs. Zinc held in the bones would, however, presumably be eliminated much more slowly.

Some months later a second case was reported independently from another part of the Waikato. The whole history of the case was practically identical with the first one, and was verified by a personal visit. Undue pallor of tissues and organs was noted in the post-mortem examination by the Veterinarian. Samples again gave similar results :—

	Percentage of Zinc on Samples as received.
Skim-milk from vat—	
Fluid portion	0·015
Curdy portion	0·083
Stomach contents (three-months-old pig)	0·100
Kidney	0·005
Liver	0·012

Other suspected cases are under investigation. It is fairly evident that some of the milk adheres to the metal surface of the pipe and is not removed by flushing with water. This film then sours and the lactic acid attacks the zinc. Further accretions of milk would rapidly take place on this already sour and decomposing film, promoting continued attack. The deposit would break away from time to time, carrying with it the dissolved zinc. It is notable that during the period when only molasses and water was fed through the pipes the mortality ceased.

The literature on the toxicity of zinc is very contradictory. Standard text-books quote cases of poisoning, and report recoveries of zinc from the organs of animals that have died following the ingestion of zinc salts. In most cases, however, the poisoning has been of an acute type due to the caustic action of zinc chloride on the mucous membranes of the alimentary tract. Experiments on the injection of non-caustic zinc compounds show, however, that zinc administered in this way causes symptoms of poisoning terminating in death. Some recent experimenters, on the contrary, claim that zinc fed in small quantities over long periods to dogs and rats is non-toxic. Drinker (*Amer. Jour. Physiol.* 80 (1): 1927, 31–64) fed cats and dogs with daily doses of zinc oxide of 0·175 gramme to 1 gramme for periods of three to fifty-three weeks. It is claimed that no significant clinical symptom or laboratory evidence of damage was observed. All three cats on the highest dosage of zinc (1 gm. per day) exhibited however, at autopsy, gross hardening and nodular development of the pancreas, which on histological examination proved to be generally overgrown with fibrous tissue, partially or wholly eliminating the islets. The liver of one of these cats thus affected contained about 0·037 per cent. of zinc. It is also evident that not more than a minute fraction of the zinc oxide fed was absorbed. Zinc oxide probably is less readily absorbed than other more soluble compounds of zinc. Again, the pig seems to be an animal peculiarly susceptible to various poisons.

Heller and Burke (*Journal of Biological Chemistry*, 1927, *74*, 85–93) fed rats with amounts of zinc salts of 0·25 per cent. and 0·5 per cent. of zinc in the diet. It is stated that no toxic effect was observed over several generations. However, the figures show that in the group receiving 0·5 per cent. of zinc as chloride there was a mortality of approximately 40 per cent. of the young, while in the group on 0·25 per cent. zinc the mortality in the young did not rise above 20 per cent. Moreover, the analytical results on the carcasses show clearly that either there was practically no absorption of zinc from the alimentary canal, or, if any were absorbed, it was eliminated immediately again by the same path. No significant increase of zinc in the organs was obtained.

Thus these results differ markedly from the cases in pigs now reported, in which clear evidence of absorption and storage is available. The total amounts of zinc consumed by the pigs have also probably been greatly in excess of the relative amounts fed in the small-animal experiments.

In view of the great extension in the method of feeding pigs with skim-milk pumped through galvanized-iron pipe-lines, and the apparent increase in obscure mortality and unthriftiness in pigs, further investigation of this matter is desirable. In the meantime caution should be exercised and the installation of extremely long pipe-lines avoided.

The co-operation of Mr. D. Marshall, Veterinarian, Hamilton, in obtaining and forwarding post-mortem findings, samples, and data is gratefully acknowledged; also that of Mr. C. R. Taylor, formerly of this Laboratory, who brought the first case under notice and obtained much

information relating thereto. The work has been carried out under the direction of the Chief Chemist, Mr. B. C. Aston, to whom our thanks are due for interest shown and advice given.

SPROUTED GRAIN FOR SEED-WHEAT PURPOSES.

I. D. BLAIR, Canterbury Agricultural College, Lincoln.

THE 1936 harvest will long be remembered for its abnormal rainfall and the great difficulty encountered in saving the late crops. The fact that 9·5 in. of rain fell between 3rd February and 14th March in Canterbury, in comparison with 1·8 in. the average for the preceding forty years, indicates that flooding seriously hampered harvest operations. Apart from the delay in seasonal work, the majority of growers had the misfortune of seeing their crops severely damaged, with the grain sprouting in the stook, and in many cases in the standing crop. Many farmers have recently been concerned about the value of sprouted lines of wheat for seed purposes. One occasionally hears of farmers who state that they have grown good crops from sprouted seed, but it must be remembered that there are various degrees of sprouted wheat, and while one man may have been successful, others may have quite different results. The question of sprouted wheat for seed purposes has been investigated, and in the May issue of the *Journal* a preliminary report on the germination of sprouted grain was issued for the benefit of those farmers who were sowing at the time. The complete results of the investigation are presented here.

DEGREES OF SPROUTING.

During the past season various degrees of sprouting were observed in affected crops. A number of ears with sprouted grain were collected from a crop in stook. Half of these were placed in a stack and left there for eight weeks. The other half was hand-threshed and the grain sorted out into four groups A, B, C, and D according to the length of the sprouts. The description of the degrees of sprouting is as follows :—

Group A : All grains sprouted and showing green shoots over $\frac{1}{2}$ in. long. There was also a great development of roots.

Group B : With green shoots $\frac{1}{4}$ in. to $\frac{1}{2}$ in. long, and extensive root-development.

Group C : With small green shoots under $\frac{1}{4}$ in. long and less development of roots than A and B.

Group D : With no sign of green shoots, but the shoot had just broken the surface of the grain. Roots were developed slightly in some cases.

The threshed grain was air-dried for different periods, and the laboratory and field germinations obtained. These are given in Tables I and II.

Table I.—Laboratory Germination of Air-dried Sprouted Samples.

Group.	After Six Days' Drying.	After Fourteen Days' Drying.	After Twenty-one Days' Drying.	After Thirty Days' Drying.
	Percentage.	Percentage.	Percentage.	Percentage.
A	90·0	77·0	57·0	57·0
B	90·0	84·5	60·0	59·0
C	95·0	93·0	80·0	80·5
D	97·0	96·6	95·0	94·0

Table II.—Field Germinations of same Samples of Sprouted Wheat after Twenty-one Days' Air-drying.

Group.	Number of Seeds sown per Row.*	Field Germination, sown 25th February.	Field Germination, sown 4th May.
		Percentage.	Percentage.
A	100	22·0	4·0
B	100	23·0	7·0
C	100	25·0	11·0
D	100	34·0	24·0

* Duplicate rows. Counts made fourteen days after sowing.

From Tables I and II it is observed that as the grain dried out the laboratory germination decreased until constant after twenty-one days. The grain showing the least sprouting—viz., Group D—revealed a high laboratory germination, but, when sown in the field, the seedling establishment was low. The field germination of the other groups when sown at the usual time of autumn sowing—viz., early in May—was very low.

In the case of the sprouted wheat stacked for eight weeks before threshing, the germination results are shown in the following table.

Table III.—Germination of Sprouted Grain after being in Stack for Eight Weeks.

Group.	Laboratory Germination.	Field Germination, sown 4th April.	Field Germination, sown 4th May.
	Percentage.	Percentage.	Percentage.
A	58·0	11·0	3·0
B	64·0	13·0	4·0
C	83·0	16·0	8·0
D	96·0	40·0	21·0

In this case the field germination of the stacked sprouted wheat was slightly lower than where the grain had been air-dried, while the laboratory germinations were about the same.

Commercial Machine-dressed Seed.

It must be realized that the data given above refer to seed in which all the grains were sprouted to some extent. Such a condition would not be likely to occur in a commercial line of seed wheat—there the proportion of slightly sprouted grains (Group D) might be only a quarter or less. In addition, it is possible to remove the badly sprouted

grain from a line of seed by machine dressing. Several commercial-dressed lines of seed wheat harvested from sprouted crops were examined, with the following results :—

Table IV.—Germination of certain Commercial Lines of Machine-dressed Seed Wheat harvested from Crops showing some Degrees of Sprouting.

Sample No.	Sprouted Grains in Dressed Samples.	Laboratory Germination.	Field Germination, sown 1st April.	Field Germination, sown 4th May.	Difference between Laboratory and Field Germination. (May).*
	Percentage.	Percentage.	Percentage.	Percentage.	Percentage.
1 (Tuscan) ..	10·0	91·0	88·0	81·0	—10·0
2 (Cross 7) ..	12·0	92·0	85·0	80·0	—12·0
3 (Tuscan) ..	..	90·0	86·0	80·0	—10·0
4 (Cross 7) ..	13·0	89·0	84·0	76·0	—13·0
5 (Tuscan) ..	..	87·0	80·0	75·0	—12·0
6 (Tuscan) ..	18·0	86·0	80·0	73·0	—13·0
7 (Jumbuck) ..	23·0	75·0	70·0	68·0	— 7·0
8 (Cross 7)† ..	..	100·0	95·0	92·0	— 8·0
9 (Tuscan)† ..	..	99·0	95·0	90·0	— 9·0

* Figures indicate the difference between field establishment, sown 4th May, and laboratory germination.

† Samples 8 and 9 represent *unsprouted* 1936 seed from crops harvested and threshed before damage by rain.

From Table V one concludes that the dressed commercial seed on the market, harvested from sprouted crops, has a lower germination capacity than seed harvested before flood damage, and that the laboratory germination gives a fair idea of the value of the seed. The laboratory and field germinations of these commercial samples are not unsatisfactory, and about 10 lb. to 15 lb. of seed additional to the normal seeding would make up for the lower germination.

Effect of Seed Pickling on Commercial Seed from Sprouted Crops.

In this trial a line of wheat and a line of barley machine-dressed, but harvested from sprouted crops, were examined. In each sample odd sprouted grains were noted. The seed was pickled as shown below, and the germination figures are shown in the following table :—

Table V.—Effect of Seed Treatments on the Field Germination of Lines of Commercial Wheat and Barley Seed harvested from Sprouted Crops.

Seed Treatment.	Wheat.	Barley.
	Percentage.	Percentage.
Untreated seed	79·0	88·0
Hot water	70·0	72·0
Formalin	14·0	40·0
Clark's Wheat Protector ..	55·0	82·0
Ceresan	79·0	87·0
Copper carbonate	77·0	88·0

The dry-dust pickles have had little effect on the germination of those sprouted lines of seed, while wet pickles, particularly formalin, have materially decreased the germination of the seed.

VINE-CULTURE UNDER GLASS.

(Continued.)

J. C. WOODFIN, Manager, Horticultural Station, Te Kauwhata.

FIRST SEASON'S TRAINING.

When the young vines were cut back during the winter, at least two buds should have been left for each rod wanted. If the vine is to be trained to a single rod two buds are sufficient, but double that number will be required if two rods are to be worked up. The reason for this is that many things may cause the loss of a young shoot, hence an extra bud should be kept in case this happens.

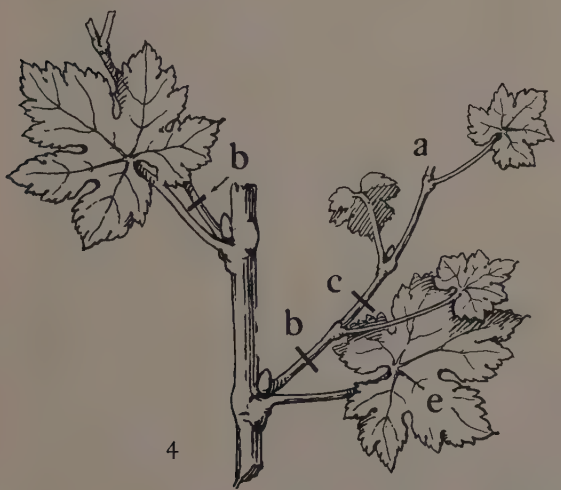
When sufficient growth has been made to enable it to be done, the leaders required should be loosely tied to the stakes previously mentioned, and when these leaders are safely established the spare shoots can be rubbed off or pinched back. When the leaders reach the wire they should be tied to it, the tying being loose to allow for the swelling of the rod. They should, in fact, be slung rather than tied under the trellis. Some incautious people train the rods over the horizontal trellis, which is now seldom used, but this is a very great mistake. When the rods are below the trellis they can be taken down for pruning and cleaning; if they are above the trellis these operations are rendered difficult, and cannot be properly performed. When the rods are underneath it is also much easier to tie the laterals to the trellis, as these always grow up towards the glass, while if their base is above the trellis it is sometimes a difficult matter to bring them down. It is a good plan, with very strong growers, to sling the rods on hooks a few inches below the trellis. This greatly facilitates the tying of the laterals.

It has already been stated that the vine makes its strongest growth at the top. This occurs not because of the height, but because this portion is the extremity of growth. Precisely the same thing occurs however many rods a vine may have. Unchecked growth draws sap to itself, and to some extent weakens other parts less favourably situated on the vine. This principle must be kept in mind, as it is a guide in the necessary control of the young growths.

If a vine in its first year were allowed to grow without check, the lateral growths would develop almost as strongly as the leader, and this would result in a very poor growth of rod. It is therefore necessary to check the lateral growths for the purpose of strengthening the rod. The laterals must not, however, be entirely suppressed, because this would cause the buds on the leader to break, which is not desirable as they are wanted to produce the laterals for the next season. Although the laterals must be left they must not be allowed to extend far, otherwise they would draw too much sap from the rod, and the buds on the main rod at the base of each lateral would not be properly developed. In addition to this evil there would be crowding of foliage, which must be avoided; all large leaves must have room to develop so that their surfaces may be exposed to the light. A few good well-spaced leaves are of greater benefit to the vine than any number of smaller and crowded leaves.

When the young vine gets fairly into growth it advances rapidly. The leader should be loosely tied as becomes necessary. Care in handling is necessary or the leader may be broken. The tips of the laterals should be pinched off when they have made three to four leaves; sublaterals when they have made one leaf. The points of the laterals will break again. These breaks should be pinched after making one leaf, and all future breaks from the laterals and sublaterals should be similarly treated. This plan of stopping is to be continued for 6 ft. or 7 ft. of the rod's length, and at this height the top of the leader should be pinched off. This will cause a temporary check in extension and will strengthen the lower part. A new leader will soon start; it should be allowed to extend at will, nor should the laterals it makes be pinched. The growth may extend so as to fill all space, but should not become a tangled mass. Enough should be removed to prevent this, as overcrowded leaves cannot fully perform their functions. Young vines that do well are able to fill a fair-sized house with growth, and the treatment here advised is based on the assumption that they will do so.

By the end of February the portions of the rods on which the laterals have been checked should have assumed a brown colour, a sign of ripening or maturity. Early in March the laterals on these portions should be cut back to their base; this will leave no lateral growth, but at each joint there should be a good leaf on the main rod. Each leaf influences the bud at its base—nourishing it and bringing it to maturity. If any of these leaves have been accidently lost the lateral at that point should not be entirely removed, but should be shortened to one leaf.



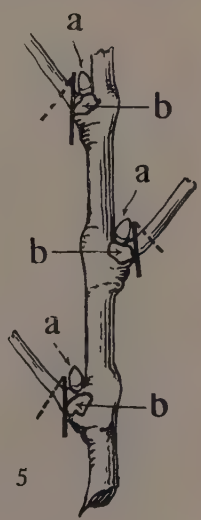


FIG. 4. YOUNG GROWING ROD.

(*a*) Where the laterals are first pinched; (*b*) where the lateral is to be cut back to in March; (*c*) where lateral should be cut in March if the large leaf at its base has been lost.

FIG. 5. WINTER PRUNING FOR A YOUNG ROD.

(*a*) The buds to form future bearing-laterals; (*b*) the wrong way to prune—the dotted line shows the right way.

During the month of May, the vinery should be ventilated as freely as possible. Any growth made at this time is of no value ; it, however, may be detrimental. The chief object now is to get the canes well ripened. The leaves should fall in June and pruning should be at once attended to. Leaves may be holding on late laterals after all others have fallen, but pruning should not be delayed for these, as they are of no consequence. Late pruning causes the vines to bleed, and if bleeding is excessive it seriously weakens the vines. The length of rod to be left depends on its strength. It may be as thick as one's thumb, and, if so, 5 ft. may be left ; if as thick as the forefinger, 4 ft. may remain ; while 3 ft. is ample for weaker rods. The stronger rods may be allowed to carry a light crop the next season, say, a bunch to every other lateral. It may be noted that if the practice of former times were followed these vines would have been cut back again to the plate or to the bottom wire.

Manuring.

It is a common custom to utilize the vinery for tomato-growing until the vines are well advanced. In such cases, if the vines are planted inside the house, they will get their share of the fertilizers and water used for this crop, and no special feeding is necessary. If the vines make good growth the roots will soon reach the outside border. If planted outside, then as soon as growth has fairly started a light mulch of manure should be applied. The mulch should not be given at too early a period of growth, however, as the warmth of the sun is required to start the vines, and mulching would shut this out. By the time the vines are in good growth the days will be longer and sun heat greater, causing the surface soil to dry quickly and the vine-roots to go down in search of moisture. It is of great importance to prevent this. The roots should be kept as near the surface as possible, for, if what may be termed the foundation roots are deep down, future roots will go deeper still unless drastic steps be taken to attract them to the topsoil. If the roots are deep down not only do they lose the benefit of the good soil in the border, but they are likely also to get into cold, sour soil, resulting in several evils, which will be dealt with later on. A mulch serves to retain moisture in the topsoil so that the roots are encouraged to work in it.

It may be well to cite a personal experience of the effect of a mulch. This was a case where vines had been planted two years and had made good growth. On examining the border no roots could be found in the top spit. They had gone straight down. The border was fully exposed to the sun and situated on a hillside. Water could not lie in the subsoil, which was of pure clay. When the vines had got a good start, and before dry weather set in, a mulch of about 10 in. of fermenting stable manure was given. By the end of the season what was left of the manure was mostly a black mould. Roots had come up and even entered the manure, while the border itself was matted with roots, and could only be loosened lightly with a fork. During the following eight years this border could not be dug, it being possible merely to loosen the surface to take out weeds. Each year a light mulch was given and some fresh loam added to the border.

The mulch on the border does not supply moisture : it merely enables the surface soil to hold it ; watering may therefore be required at times. Liquid manure should not be given to a young vine, which having a new border to work in, will find all it requires.

Ventilation.

Where tomatoes are grown inside, treatment will, of course, be adapted to that crop, but the requirements of the two kinds of plants are in some respects different. Tomato-houses are generally, and quite rightly, kept as dry as they can be; grapes like more moisture. This is a reason why tomato-growing should be discontinued as soon as the vines have reached the stage of producing a fair crop. The young vines should be well syringed at closing-time, or they may become attacked by red spider. Where the vines alone are cultivated in the house the top ventilators should be opened early in the morning so as to secure a movement in the atmosphere to carry off moisture that has condensed during the night. The bottom ventilators should not be opened until the moisture on the leaves has been dispersed, otherwise the plants become more susceptible to the attack of mildew. When the night moisture has disappeared the floor may be damped down so as to create what is termed a buoyant atmosphere, a condition in which the vine flourishes.

It may seem strange to advise getting rid of the night moisture because of the fear of mildew, and then damping down. The explanation is that condensed moisture on the leaves is in the form of globules of water. If the sun shines strongly on the house before the water is dispersed very rapid evaporation is caused. This lowers to nearly freezing-point the temperature of the spot on which the globules of water are seated, and mildew ensues. Rapid evaporation is also caused by the admission of a current of air, with the same result; this is why the bottom ventilators should not be opened while the leaves are wet. The effect of the wind on moisture situated on a body is easily understood by the experience of bathers. One may come from water that is much colder than the atmosphere, yet shiver with cold. This is because the wind, together with the heat of the body, causes rapid evaporation, and consequently a very much lowered temperature on the skin. Much the same phenomenon occurs on vine-leaves. On the other hand, water thrown on a floor rises as vapour and tempers the atmosphere, but does not settle on the leaves.

During the spring the house should be closed before the sun has quite ceased to shine on the roof, and the vines then should be well syringed. This must be done in a thorough manner so that the rods get their share as well as the leaves. A thorough syringing in the evening and prevention of an arid atmosphere during the day are usually sufficient to prevent attacks of red spider and thrip. After the evening syringing the vines and house will be wet, but this state should not last long. If the house has been closed while the sun is still on the roof the temperature will have risen a few degrees, and this extra warmth will cause a good deal of the moisture to be dispelled as vapour. On dull or rainy days no damping-down or syringing should be done, as the atmosphere will be damp enough without it.

THE SECOND SEASON'S TRAINING.

The establishment of the vines, treatment during the first season, and the first winter pruning have already been dealt with. In the following season strong vines may be allowed to carry a little fruit, but the main purpose should be the extension of the rods. General

treatment—stopping growths, &c.—should be the same as for the previous season, except that where laterals are carrying fruit a different system of stopping is necessary, which will be dealt with later on. With regard to the length of rod to be left at the second winter pruning, opinions and practice among good cultivators vary greatly. In earlier days the usual custom was to work the rods up slowly, heavy cutting-back each season being the rule. For a good many years, however, many first-class growers have abandoned the old plan, maintaining that where vines make good rods they are quite able to carry some fruit, and that nothing is gained by cutting them back, and, further, that any harm done is caused by overcropping the young rod rather than by not cutting it back. If really good growth is made, resulting in stout rods, a length of 10 ft. or 12 ft. may be left at pruning-time, but such a length of new rod should rarely be allowed to carry, during the next season, more than one bunch to every other spur. Weaker rods should be cut back farther, as previously mentioned.

(To be continued.)

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 23rd April, 1936, to 21st May, 1936, include the following of agricultural interest:—

No. 74305: Incubator; H. J. L. Williams. No. 74338: Dipping sheep; R. E. Picker. No. 73383: Water-sprayer; W. J. G. Craig. No. 74423: Milk-cooler; F. W. Davenport. No. 75201: Cart; A. and H. A. Deas and J. Piper. No. 75354: Wool-cleaning machine; Fitger California Co. No. 75789: Harrow; R. M. Wilson. No. 75790: Cleaning wool; Chemicals Precipitation Pty., Ltd. No. 73920: Wheelbarrow; J. S. Whitaker, S. C. Gurney, and A. H. Balderston. No. 74062: Hay-stacking device; A. C. Anderson. No. 74295: Harrow-tine; R. M. Wilson. No. 74634: Aerating lawns; W. Hargreaves and Co., Ltd., and W. Hargreaves. No. 74686: Manure-distributor; J. H. Mason. No. 75538: Shearing-machine; Chicago Flexible Shaft Co. No. 75762: Egg-carrier box; K. K. Newsom. No. 75880: Gate; W. H. Bennett.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

DEPARTMENT OF AGRICULTURE.
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THE PRIMARY PRODUCTS MARKETING ACT, 1936.

THE Primary Products Marketing Act, 1936, which came into force on 15th May, is an Act to make better provision for the marketing of dairy-produce and other primary products so as to ensure for producers an adequate remuneration for the services rendered by them to the community. The Act is divided into three parts—viz., Part I, Administration; Part II, Marketing of Dairy-produce; and Part III, The New Zealand Dairy Board.

PART I: ADMINISTRATION.

By this Part a member of the Executive Council may be appointed by the Governor-General as the Minister of Marketing, and a Department of State called the Primary Products Marketing Department is established. The Department, under the control of the Minister, is charged with the administration of the Act.

Provision is made for the appointment of a Director of Marketing, who shall be the administrative head of the Department. One or more Assistant Directors of Marketing may also be appointed, and such other officers as may from time to time be considered necessary. Any member of the Executive Commission of Agriculture may be appointed to be the Director or Assistant Director of Marketing, and any officer of the New Zealand Dairy Board or any person who has technical or other expert knowledge of the dairy industry may be similarly appointed a permanent officer of the Department.

The principal functions of the Department are to make all necessary arrangements with respect to—

(*a*) The acquisition on behalf of the Crown of any primary products in accordance with the Act or any other lawful authority that may be conferred:

(*b*) The marketing in New Zealand or overseas of primary products whether acquired by the Crown or not.

After the coming into force of the Act no contract for the carriage by sea of any primary products intended for export shall be made except by the Minister or in conformity with conditions approved by the Minister. The functions of the Executive Commission of Agriculture are transferred to the Department, and the Executive Commission of Agriculture shall be abolished on a date to be fixed by the Governor-General in Council. While the Commission remains in existence it shall have such powers as may be delegated to it by the Minister.

All the functions of the Department may be exercised by the Minister, who may delegate to the Director of Marketing such of his powers as he thinks fit. Any such delegation may be made generally or in relation to any particular matter or may be made subject to such conditions and restrictions as the Minister thinks fit. Similarly, any Assistant Director of Marketing may, with the written authority of the Director of Marketing, exercise any of the powers of the Director. The Director of Marketing acting with any Assistant Director or any other person or persons appointed by the Minister shall have all the powers of a Commission of Inquiry appointed under the Commissions of Inquiry Act, 1908, for the purpose of obtaining any information deemed necessary or of value to enable the Department to fulfil its functions or to enable the Government to determine whether the functions of the Department should be extended or varied.

For the purposes of the Act an account to be known as the Dairy Industry Account shall be established at the Reserve Bank of New Zealand. The Government has unlimited power to borrow by way of overdraft from the Reserve Bank moneys in aid of the Dairy Industry Account, and the account may be overdrawn accordingly. Subsidiary accounts may also be opened at the Reserve Bank or at any other bank in New Zealand or elsewhere. All moneys received from the sale of dairy-produce shall be paid into the Dairy Industry Account, together with all other moneys lawfully payable into the account. All moneys payable by the Crown in respect of the price of dairy-produce or the freight, insurance, storage, or marketing of dairy-produce

and all other expenditure incurred in the administration of the Act, including the salaries and allowances of officers, shall be payable out of the account. An annual report on the operations of the Department as at 31st July, together with statements of account for the preceding twelve months, must be prepared and presented to Parliament. All regulations required for the purpose of giving effect to the Act may be made under the powers conferred by section 27 of the Agriculture (Emergency Powers) Act, 1934.

With a view to the promotion of reciprocal trade the Minister of Marketing is empowered to arrange the terms of provisional trade agreements with the Governments of other countries, negotiating first with the accredited representatives of the United Kingdom Government, then with those of the Government of any other part of the British Empire, and finally with the accredited representatives of the Government of any other country. The basis of any such agreement shall be that, in consideration of the purchase of any primary products of New Zealand by the Government of the overseas country or of the establishment or maintenance in such country of favourable marketing-conditions for any primary products of New Zealand, the New Zealand Government will undertake to arrange through the Reserve Bank for the whole or a substantial part of the financial credits thereby established in such country to be utilized in the purchase of approved goods or classes of goods produced or manufactured in that country.

Part II: Marketing of Dairy-produce.

For the purposes of Part II the term "dairy-produce" is defined to include milk, cream, butter, cheese, and all other products of milk or cream, whether derived by manufacturing processes or otherwise. It also includes any other products of a kind derived from the operations usually carried on in conjunction with dairy-farming operations (such as the rearing of calves and pigs), whether such products are actually produced on dairy-farms or elsewhere.

For the present, Part II of the Act applies only to butter and cheese that is manufactured from milk or cream delivered to a dairy-factory on, or at any time after, 1st August next, but the Minister may, by notice published in the *Gazette*, apply the provisions of Part II to any other kind of dairy-produce. Part II does not apply to dairy-produce that is both produced and consumed in the Chatham Islands. Wherever in the notes that follow, so far as Part II is concerned, reference is made to dairy-produce, it should be noted that for the present the term means butter and cheese so manufactured. The Minister has full authority to make such arrangements and give such directions as he thinks proper for the handling, pooling, transport, and storage of dairy-produce, the shipment of dairy-produce intended for export on such terms and in such quantities as the Minister thinks fit, the insurance against loss of dairy-produce, and generally for all matters necessary in the exercise of any powers expressly conferred upon him by the Act.

All dairy-produce intended for export shall become the property of the Crown as soon as it is placed, with the concurrence of the Department, on board any ship for export, but the Minister may, by notice published in the *Gazette*, determine that the ownership shall pass to the Crown at any specified time prior to shipment. Upon the ownership of dairy-produce passing to the Crown the price to be fixed in accordance with Part II shall become payable to the owner of the dairy-factory or other person entitled thereto after deducting the amount of the levy (if any) payable to the New Zealand Dairy Board. The prices to be paid for dairy-produce exported shall be fixed by Order in Council. Different prices may be fixed for different kinds of dairy-produce, or for different grades or qualities of the same kind of produce, or for the same kind or grade or quality of any dairy-produce by reason of any special conditions or circumstances which in the opinion of the Governor-General warrant the fixing of different prices. The prices to be fixed for dairy-produce manufactured on or after 1st August and exported on or before 31st July, 1937, shall be fixed after taking into consideration the prices received in New Zealand for dairy-produce of the

same or approximately the same kind, grade, and quality exported during a period of from eight to ten years prior to 31st July, 1935. The prices to be fixed for dairy-produce exported after 31st July, 1937, shall be such that any efficient producer engaged in the dairy industry under usual conditions and in normal circumstances should be assured of a sufficient net return from his business to enable him to maintain himself and his family in a reasonable state of comfort, and shall be so fixed after taking into consideration the following matters :—

(*a*) The prices fixed for dairy-produce exported before 31st July, 1937 :
(*b*) The necessity in the public interest of maintaining the stability and efficiency of the dairy industry :
(*c*) The costs involved in the efficient production of dairy-produce :
(*d*) The general standard of living of persons engaged in the dairy industry in comparison with the general standard of living throughout New Zealand :
(*e*) The estimated cost to the Department of marketing the dairy-produce concerned :
(*f*) The cost of the general administration of the Act :
(*g*) Any other matters deemed to be relevant.

With regard to dairy-produce intended for sale for consumption in New Zealand, the Minister may determine that the ownership thereof shall pass to the Crown as and when the Minister shall specify by notice published in the *Gazette*. Alternatively, the Minister may determine that the Department shall control the marketing of such dairy-produce but that the ownership thereof shall not pass to the Crown. At any time after the fixation of prices for dairy-produce exported or intended to be exported prices may be fixed by Order in Council in respect of dairy-produce intended for local consumption, whether it has been or is intended to be acquired by the Crown or is sold or intended for sale otherwise than to the Crown. In fixing the prices to be paid to any dairy company for dairy-produce manufactured by it (whether such price is to be paid by the Crown or by any private purchaser) the general purpose shall be to assure to the producer a net return from his produce equivalent to the return that he would have received if such produce had been acquired by the Crown for export. In fixing other prices of dairy-produce the general purpose shall be to ensure that the consumer will be able to obtain the produce at a reasonable price, and that the retailer and other persons engaged in the distribution of the produce will receive a fair and reasonable remuneration for efficient services. Subject to the foregoing general conditions the Governor-General may fix such prices for dairy-produce intended for sale for consumption in New Zealand as he thinks fit. The validity of any Order in Council fixing the prices for dairy-produce shall not be questioned on any ground whatsoever.

If after prices for dairy-produce have been fixed any dairy-produce is manufactured of a kind, grade, or quality for which prices have not been fixed, or does not conform in all material particulars with the requirements of the Department, that dairy-produce may be sold only in accordance with the direction of the Minister. Every person who, whether as principal or agent and whether by himself or his agent, sells or disposes of dairy-produce otherwise than in accordance with the directions of the Minister or at other than the appropriate price for that dairy-produce commits an offence against the Act. The giving or offering of any unauthorized rebate, refund, discount, allowance, premium, or other valuable consideration in relation to the sale of dairy-produce in respect of which prices have been fixed is also an offence. Liability for the commission of an offence against the Act is a fine of £200 in the case of an individual and £1,000 in the case of a company or other corporation.

Part III : New Zealand Dairy Board.

Part III of the Act comes into force on 1st August next. On that date the New Zealand Dairy Board is to be reconstituted. The present Government members shall be deemed to have vacated their offices, and thereafter

the Board shall consist of five members—viz., the present four producer members and one member as the representative of the Government. Any one of the members vacating office may be appointed to be the Government representative on the Board.

The present powers of the Board with respect to the control of dairy-produce intended for export or for sale for consumption in New Zealand are repealed as from 1st August. Thereafter the Board shall not exercise any of its powers, functions, or discretions except with the approval of the Minister of Marketing. The functions of the Board with respect to dairy-produce, not being dairy-produce to which Part II of the Act applies, may at any time after 1st August next be exercised by the Minister, or by the Board with the approval of the Minister, as if Part II of the Act applied to such dairy-produce, whether or not such dairy-produce has been exported before the passing of the Act and has not been finally disposed of or is exported after the passing of the Act. Any such approval may be general or special, and may be absolute or subject to such conditions as the Minister thinks fit to impose. All contracts of the Board subsisting on 1st August next become contracts of the Crown in so far as they relate to the storage, insurance, or freight of the dairy-produce to which Part II of the Act applies. The property of the Board in the National Fern Leaf design registered in the United Kingdom is transferred to the Crown with effect from that date.

—A. E. Morrison, Solicitor, Department of Agriculture, Wellington.

SEED-POTATO CERTIFICATION.

EXTENSION OF SCHEME TO CERTAIN DISTRICTS IN THE NORTH ISLAND.

It has been decided to extend the scheme of Government certification of seed potatoes, at present operating only in the South Island, so that in the 1936–37 season crops being grown in certain localities in the North Island may also be included in the scheme.

The district to which certification is to be extended is that potato-growing area to the north of Marton, and extending as far as the Ohakune district. Any crop in this district, in order to be eligible, must be grown at an altitude of not less than 1,500 ft., while the following conditions must also be complied with before an area can be considered for certification :—

(1) The seed being planted must have been certified by the Department of Agriculture in the "Mother" class.

(2) The minimum acreage of any one area will be 1 acre.

(3) Applications for certification in the ensuing season must be in the hands of the local Instructor in Agriculture at Wanganui on or before the 31st August next.

(4) It will be necessary for the local Instructor in Agriculture to collect a representative sample of 200 tubers of the seed being planted. This sample will be grown in the Department's trial plots in comparison with other lines of the same variety.

(5) The fees payable in connection with the certification of any area are as follows :—

  (*a*) A sample trial fee of 10s. which must accompany the grower's application. (This fee covers all lines entered by one grower on one farm.)

  (*b*) A field inspection fee at the rate of 2s. 6d. per acre, with a minimum of 10s., which must be paid prior to crop inspection, and on or before the 20th December in each season.

(6) In the meantime no seed will be certified in other than the "Commercial" class.

Growers interested in the scheme may obtain further information, together with application forms, from any officer of the Fields Division of the Department of Agriculture.

—Fields Division.

CITRUS INDUSTRY.

In recent years there has been a considerable increase in the area devoted to citrus-culture. The total area is estimated to be in the vicinity of 1,884 acres, comprised of lemons, 1,300 acres; and oranges, 584 acres. At the 1st October, 1934, there were 85,973 lemon-trees and 37,399 orange-trees in registered orchards, and at the same date the following year the respective totals were 91,032 and 40,909 trees.

From the orchard registration records the following table showing the number of registered citrus-growers in the Dominion, classified in districts according to size of orchard, as at 1st October, 1935, has been prepared :—

Table showing the Number of Registered Citrus-growers in the Dominion classified in Districts according to Size of Orchard as at 1st October, 1935.

Group, Number of Trees ..	1–50 Trees.		51–350 Trees.		351–1,000 Trees.		Over 1,000 Trees.		Totals of Trees.
District.	Number of Growers.	Number of Trees.	Number of Growers.	Number of Trees.	Number of Growers.	Number of Trees.	Number of Growers.	Number of Trees.	
Whangarei	208	2,427	55	7,879	37	18,663	4	8,278	37,247
Auckland	732	10,650	241	29,734	18	9,332	..	..	49,716
Hamilton	149	842	5	497	..	..	..	..	1,339
Tauranga	281	2,886	88	13,253	17	8,826	2	3,212	28,177
Gisborne	180	1,849	17	2,363	1	420	..	..	4,632
Hastings	244	2,197	21	2,407	..	..	..	..	4,604
Masterton	13	70	..	..	..	..	..	..	70
Palmerston North ..	215	1,134	3	267	..	..	..	..	1,401
Wellington ..	23	93	1	60	..	..	..	..	153
Nelson	71	454	14	1,530	1	450	..	..	2,434
Mapua	36	317	6	457	..	..	..	..	774
Motueka	65	370	6	593	..	..	..	..	963
Blenheim	99	367	..	..	..	..	..	..	367
Christchurch ..	23	51	..	..	..	..	..	..	51
Dunedin	2	13	..	..	..	..	..	..	13
Trees	..	23,720	..	59,040	..	37,691	..	11,490	131,941
Growers	2,341	..	457	..	74	..	6	..	2,878
Percentage of total number of growers	81·34	..	15·88	..	2·57	..	0·21	..	..

—*W. K. Dallas, Citriculturist.*

As a result of conflicting reports on the ability of a super-lime mixture to eliminate the bad effects of super alone on the germination of turnip-seed, an investigation into the ability of ground limestones to revert the water-soluble phosphate into water insoluble phosphate, but still leaving the phosphate in a form available to plants, has been carried out. The presence of sufficient moisture is one of the main essentials to efficient reversion. In a dry condition very little reversion takes place in spite of several months in intimate mixture. In this case reversion cannot take place until the mixture is applied to the soil. If the soil is dry and the dry superphosphate-lime mixture is sown with turnip-seed considerable germination injury may take place. If, however, water is added to the mixture prior to sowing rapid reversion takes place, and if not too large amounts of water are added the mixture, after reversion, will be in a dry state suitable for drilling. Fineness of grinding of the lime considerably affects the rate of reversion, but differences inherent in the original limestone are responsible for the greatest differences. For example, ground limestones from certain districts when used with superphosphate will correct the harmful effect of the superphosphate much more effectively than ground limestone from certain other districts, although the fineness of grinding and the total calcium carbonate ($CaCO_3$) may be practically the same.—*Report, B. W. Doak, Chemist.*

SEASONAL NOTES.

THE FARM.

Labour Economy.

OF prime importance is the share of farm returns available for the payment of the labour of the farmer and his employees, including possibly members of his family. The proportion of the farm returns available for the payment of labour is determined to a large extent by the efficiency of the labour itself. Observation and investigation have shown that some of the matters which contribute towards the efficient use of labour and which well may be given attention at this season are—

1. The work should be planned in advance.

2. There is a most suitable time for doing much work, and such work should be done on time. Most farm work can be done most quickly, most cheaply, and most effectively if it is done at the right time. The preparation of the land for seed-sowing and the control of weeds are striking instances.

3. Heavy crop-yields are commonly associated with high labour returns. This may be realized readily by comparing the net returns from a 10-ton an acre and a 5-ton an acre crop of potatoes—such a comparison illustrates the general position.

4. Heavy production of live-stock is commonly associated with high labour returns. As a rule the cow producing 360 lb. of butterfat does not call for twice as much outlay in land, labour, &c., as does the cow producing 180 lb. of butterfat, and similarly the requirements of the sow producing fourteen pigs a year are not twice as great as those of the sow producing seven pigs a year—the latter is approximately the average figure.

5. Labour-saving equipment should be employed. Apart from the purchase of labour-saving machinery, this may call for the construction of suitably located ensilage trenches or pits. It may also call for alterations in pig-keeping layouts, &c.

6. The fields should be arranged so as to make possible the best use of crops and of machinery. To achieve this result with pastures, further subdivision often is advisable.

7. The farm business should be large enough to keep the available supply of labour fully and efficiently employed. Proper attention to this matter often would lead to increased arable cropping on both sheep-farms and dairy farms dominantly dependent upon grassland. Likewise, on many dairy farms it would lead to increased attention to pig-keeping, especially in conjunction with increased arable cropping.

No attempt has been made to arrange the above seven matters affecting labour economy in the order of their importance, which varies from farm to farm; but the first and the seventh are probably of the greatest general importance, and this primarily because of the wide lack of attention to them.

Planning of Work.

Planning of farm work is a task of major importance, and it has been well established by experience that the greatest rewards in farming have gone to those whose operations are best planned. A good deal of useful planning may fittingly be carried out at this stage—*e.g.*, the preparatory work in the provision of reserves of feed for use in periods of scant growth of pastures. In this connection, of primary importance is the fact that often the provision of feed is based on the requirements of the class of stock of major importance while the needs of stock of less, but nevertheless considerable importance, are overlooked. For instance, on North Island dairy farms the cropping often seems not to take into account the needs of

pigs and of poultry, and similarly on South Island mixed farms on which grain crops and sheep are dominant, the needs of small dairy herds and of pigs are ignored; this, in both Islands, with considerable detriment to net returns. This introduces consideration of the seventh matter mentioned above, the advisability of keeping labour fully and effectively employed.

Labour Utilization.

An important matter in labour utilization is the avoidance as far as possible of idle periods at one stage, and of overcrowded periods at another stage. In this connection it should be remembered the opportunity for improvement of farm income is often greater through changes in enterprise combinations than through improved methods within single enterprises. Dairying often strikingly illustrates this. It may be possible by pasture-improvement, top-dressing, &c., to raise the carrying-capacity to an extent which means too much work for, let us say, two full-time workers, but not enough work for three full-time workers. In such cases an advantageous procedure often is to give such additional attention to pig-keeping and special cropping as fully justifies the employment of three full-time workers. The special cropping is likely to react advantageously on the butterfat-production as well as on the pig-keeping. The total result is a better all-round economic position; although the increase in butterfat-production and the pig-keeping as separate enterprises may not be economic, as an enterprise combination they are distinctly attractive.

General Cropping Work.

The working of land intended for cereals should now be given precedence. On the basis of experience it is customary to sow the greater part of the spring wheat area in August and September. In some districts, especially in the North Island, good crops may be obtained from later sowings, but, as a rule, in the main grain-growing districts the yields are not so heavy from such sowings.

The sowings of oats as a rule should follow the sowing of wheat as opportunity offers. Good results often follow the sowing of black skinless barley in August.

A heavier amount of seed should be used with spring-sown cereals—*e.g.*, in the main South Island wheat-growing districts 1½ bushels to 1¾ bushels of Tuscan seed is accepted as suitable for autumn sowing, but 2 bushels or more are used for spring sowing.

Spring-sown cereals usually benefit from rolling of the ground after sowing, but, except in the case of light land, the rolling should be deferred until September or October, instead of being carried out immediately after drilling.

When autumn-sown cereals are to be utilized for chaff or grain, the final feeding-off generally should take place towards the end of August, but in the case of crops on such rich ground that "lodging" may be expected, it is of assistance in avoiding "lodging" to carry out the final feeding-off in September. Generally, after the final feeding-off, it is advantageous to give the crop a stroke or two of the tine harrows for the purpose of loosening the trampled soil and of scattering stock-droppings. Spring feeding-off of cereals should be done by stocking heavily for a short period when the ground is not excessively wet.

The remarkable increase in pig-keeping which has taken place is considered to be the forerunner of a further substantial increase, which will involve the growing of crops specially for feeding to pigs. Considerable field experience shows that mangels, swedes, chou moellier, and carrots are suitable for this purpose, and that these crops fed in considerable quantities to pigs in winter and early spring are giving quite attractive returns. Of these the mangel is specially worthy of consideration, both because of its high potential yield of suitable feed an acre and also because

of the fairly common belief that the mangel is in some way unsuitable for pigs. Relative to this the feeding of mangels as the only constituent of pigs' diet is not recommended, just as a diet of other feeds alone, such as swedes, is not recommended. But there is no reason to doubt the safety of either of these crops when fed judiciously. Actually fully matured mangels have been fed widely with success as a substantial portion of pigs' rations. In giving mangels and similar roots a place in the feeding of pigs abrupt changes should be avoided, and the quantities of such crops fed should be small at the beginning and increased gradually. Root crops and similar other crops such as chou moellier are approximately intermediate in character between concentrates and coarse feeds—a fact which must be kept in mind in feeding them to the best advantage. Detailed information may be obtained on application.

On many widely distributed North Island dairy farms handsome returns have been obtained in recent seasons from feeding to pigs maize, barley, and field peas grown on the farms on which they are used. Though it is probable that in certain dairying districts this practice would not be advisable, the experience already available indicates that it is advisable, at present prices for pig-products, over wide areas in the North Island, including ones in which but little or practically no cropping is being done. It is of importance that the adoption of the practice does not call for special outlay in equipment not ordinarily in use on dairy farms—barley and peas may be cut with the mower, and all threshing may be done, and that thoroughly, by pigs.

Italian rye-grass and Western Wolths, which often can be sown with good results at the end of August, serve as special forage crops suitable for the provision of hay or silage if necessary.

As far as possible grazing of established lucerne, especially during winter and early spring, should be avoided. Grazing necessarily causes consolidation, which favours the establishment of such plants as rye-grass and white clover, which thrive only at the expense of the lucerne. Harrowing of established lucerne, even though it is weedy, generally is inadvisable at this season unless the conditions allow one to lessen substantially the number or the vigour of the weeds without undue damage to the lucerne itself—this is quite unusual. In the main grass-farming districts the only harrowing that as a rule is effective in the control of weeds is one carried out about January or February, when the dry conditions, in conjunction with the rapid growth of the lucerne itself, lead to suppression of weeds disturbed by cultivation. It is considered that more harm than good has been done by indiscriminate cultivation of lucerne as a routine measure.

Seed-treatment for disease-control in spring-sown cereals should not be overlooked. Probably the treatment of oats and barley is more neglected than is that of wheat; it should be kept in mind that smut is decidedly objectionable in an oat crop which is to be chaffed, and that the Algerian oat is subject to smut. In recent years there have been some important developments regarding the seed-treatment of cereals. If seed-treatment is not done in the proper manner it is likely either not to bring about control of disease or to result in grave injury to the seed. Full information about suitable treatment is available from the Department of Agriculture.

Pasture Management.

A farmer who has not top-dressed already as extensively as is warranted may carry out top-dressing at this stage with every confidence that on suitable swards he will secure good results. Much benefit has resulted from top-dressing in July and August—indeed, the value of top-dressing was largely established by, and much of whatever top-dressing tradition

we have has been built mainly upon, winter and early-spring top-dressing. Ordinarily superphosphate should be used almost always at this season when an objective of the top-dressing almost invariably is an increase, as quickly as possible, in the feed available. And superphosphate is the quickest in action of the phosphatic fertilizers. Whether quickly acting nitrogenous fertilizers such as sulphate of ammonia should be used in addition to the superphosphate to stimulate growth still further, as was discussed in these notes in May, is a matter for each farmer to decide according to his own circumstances. Under some circumstances the use of other phosphatic fertilizers may be advisable, and at times the use of supplements to phosphates such as materials containing lime and potash may be profitable. Information about the use of these materials may be obtained from district officers of the Fields Division. As a rule the first consideration is the supply of phosphates.

Harrowing of pastures is commonly advisable in August, and if not done on fields on which animal manure is plentiful the spring growth of the pastures will be very uneven because of the development of patches of rank growth in the vicinity of the undisturbed droppings. It is not at all easy to deal satisfactorily with rank patches of grass-growth on farms carrying mainly "wet" stock, and so harrowing which obviates such patches is particularly useful.

Young pastures, and especially those sown with seed-mixtures designed to give swards as permanent as possible, should be treated with particular care during winter and early spring. Two faults to be avoided as far as is practicable are over-severe grazing and over-lenient grazing. The latter is particularly inadvisable if the sward contains a considerable proportion of Italian rye-grass which, if allowed, tends to outgrow and weaken more persistent valuable species in a sward. Over-severe grazing, which readily leads to a setback to valuable species before they have properly established themselves, is much more likely than over-lenient grazing to happen in the spring. The proper remedy for it, which should be kept in mind in any planning of work, is the building of adequate reserves of feed for use in winter and early spring.

Instead of waiting for improved drainage to enable a high-class mixture of the rye-grass – cocksfoot – white-clover type to be sown with success, it is sometimes advisable to establish species which yield satisfactory supplies of feed under badly drained conditions. This may mean using such species as meadow foxtail, *Poa trivialis*, *Lotus major*, strawberry clover, sweet floating-grass, *Poa aquatica*, &c., according to the conditions. Detailed information about suitable plants for badly drained situations may be obtained from local officers of the Fields Division.

—R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Pruning.

PRUNING which has not been completed should be pushed ahead as rapidly as possible to ensure its completion before spraying commences.

The principles of refurnishing trees with new fruit-bearing laterals should be borne in mind. The older and more exhausted fruiting wood should be cut away and selected new lateral growth left to take its place in the fruiting sequence. The fruiting wood should be well spaced so as to avoid an undue density of growth to enable the buds to be exposed to light and air. This allows of more efficient spraying and favours greatly improved colour in the fruit at harvesting time.

All the prunings should be gathered and destroyed, and not left lying around or just gathered and dumped in a heap in some vacant area.

Planting.

Before planting is commenced it is desirable that the land should be thoroughly worked and adequate shelter provided.

The marking-out of new areas and the planting of the trees may now be proceeded with providing the condition of the soil is suitable. The trees should be firmly planted. If adequate shelter from strong winds has not been provided, stakes should be driven in alongside the trees, so that each tree may be supported by tying to the stake.

At planting a dressing of ¼ lb. of blood-and-bone manure should be placed in the hole and then well mixed with the soil, as it materially assists the tree. Cultivation should be regularly attended to during the spring and summer months.

In the spring, when the buds are commencing to break, an application of ¼ lb. of a nitrogenous manure assists in effecting a more vigorous growth in the young trees during their first year.

Manuring.

The application of phosphatic and potassic manures should be made prior to the deepest ploughing, while nitrogenous manures may be applied at a later period in the spring. The quantities per tree of a complete manure should approximate 1 lb. per bushel of the annual fruit-yield per tree—that is, for example, a tree averaging 4 bushels of fruit per annum would receive 4 lb. of manure. The manure-mixture should be comprised of phosphate (approximately) half, potash (sulphate) quarter, and nitrogenous fertilizer quarter, respectively, of the total content. Where considered desirable, additional nitrogen may be added to the mixture.

As a nitrogenous manure promotes growth and leafage, it may be used to advantage on the poorer soils and where trees have become stagnant and lacking in sufficient new growth. If nitrogenous manure is used to excess, however, sappy growth is promoted, with which is generally associated fruit of poorer colour and of soft texture, which is more liable to break down during storage. Such fruit is also more readily bruised by the handling received during harvesting operations and in transit to the market. As a general rule, peaches and nectarines require a greater amount of a nitrogenous manure than do apples, pears, and plums.

Potash, on the other hand, if used in excess, has an opposite effect, and may be used to advantage where trees are showing excess growth. By its use an improvement is secured in the quality of the fruit, the texture of which becomes firmer and better able to withstand handling during transit to market. The fruit will also hold up better during storage. If potash is used to excess the size of the leaves becomes restricted and the leaves readily fall, while growth is retarded. Our orchard soils which are in full cultivation seldom lack potash, and on this account only a relatively small amount is recommended.

Following the autumn ploughing, carbonate of lime, at the rate of from ½ ton to 1 ton per acre, should be applied to the cultivated surface of orchard soils considered to be deficient in lime.

General.

Where it is intended to rework trees during the spring by grafting, the scions of the desired varieties, if not already taken, should be selected now and heeled-in in a shady position.

The first spray of Bordeaux 5–4–50 should be applied to stone-fruit trees during the month of August.

Where adequate shelter has not yet been provided, the planting of shelter-trees should now be undertaken. A little care in setting out the shelter-trees in cultivated ground, together with a light dressing of manure followed by cultivation around the young trees during the spring and summer months, greatly assists the trees to become established and make good growth.

It is advisable to complete ploughing operations well before the fruit-trees commence growth, so that the roots are not unduly disturbed and damaged at the critical time of fruit-setting.

—R. G. Hamilton, Orchard Instructor, Hamilton.

Citrus Culture.

Since the notes for the June issue of the *Journal* were written there have been quite a number of severe frosts in the Auckland district, and unless growers have acted upon the advice which has been given in the citrus notes from time to time relative to the use of heaters it is possible that considerable damage has been done to both trees and fruit. It is very important that growers be prepared for visitations of this kind; and although these notes are too late to obviate possible damage, nevertheless they may serve as a warning to many and stimulate greater activity and preparedness in future seasons.

It is advisable to make a careful inspection of the crop in order to ascertain whether the fruits have been damaged. Damage done to the trees is serious enough, but when the fruit is injured it is much more serious. Frost injury causes the juice to dry out, leaves the fruit very spongy, and makes it unfit for marketing. If fruit of this kind is sold, the reaction of the consumer doubtless will be reflected in a decrease in the sales of New-Zealand-grown citrus fruits for quite a long time, and every grower will be affected thereby.

It is probable that preparations are well in hand in some orchards for the coming planting season, but there may be some who have overlooked consideration of a number of details. The advice given herein from time to time should be followed, and no operation, however small, should be neglected. It is very advisable to keep in mind the danger of planting until adequate shelter has been provided and the soil has been thoroughly prepared. The delay of a season, or even more, to enable the shelter-trees to become established and the land drained and cultivated is not lost, but rather it is time gained, as it results in the trees growing very much more quickly and coming into profitable bearing sooner.

The attention of the grower is directed to the notes in the June issue of the *Journal* in regard to the picking and handling of the fruit. There is ample evidence that quite a large proportion of the moulds that are so troublesome in the curing and grading sheds can be traced to carelessness by the grower in harvesting and subsequent handling and transport of the fruit to the sheds. It is imperative, therefore, to exercise the greatest care, to use gloves when picking, and to see that the finger-nails are kept closely trimmed. Cut the fruit-stalk back neatly to the button, place the fruit carefully into boxes, see that the cases are not filled too full, and that they have no rough edges or protruding nails, and last, but not least, the vehicle used to convey the fruit to the shed should run as smoothly as possible, so as to avoid bruising of the fruit in transit from the orchard. Attention to this materially assists in removing some of the principal causes of some of the losses which are being experienced with our fruit in a number of packing-houses.

—L. Paynter, Orchard Instructor, Auckland.

POULTRY-KEEPING.

Breeding Notes.

No time should now be lost in making up the breeding-pens for the coming season if this has not already been done. Though eggs generally prove fertile from seven to nine days after stock have been mated, it is advisable to have the birds mated up some little time before eggs are required for incubation. As a general rule, one male bird to each eight or ten hens of the heavy breeds and one male to twelve hens of the light breeds gives good results.

Where flock-mating is practised—*i.e.*, where several males are mated to a flock of hens—it is well to put in an extra male to start with, as very often a male is lost through fighting.

The best results usually are obtained when second-year hens are mated to well-developed cockerels. Third, or even fourth, year hens, if active and of good type and in good breeding-condition (not overfat), give fine results. Some breeders like the older birds as breeders, but, owing to the fact that the older hens take a longer time to come back to laying after the moult, the majority of poultry-keepers prefer the second-year hens.

Although it is advisable to get the hatching over within a reasonable time, it is unwise to place in the breeding-pens hens or males that are not up to standard. In some cases where trouble has been experienced with the hatching and rearing, an examination of the breeding-stock has shown that the owner, in his desire to increase his flock and shorten the breeding season, to some extent has sacrificed quality for quantity.

The primary cause of many poultry ailments and disease is breeding from immature or inferior stock, and the best way to avoid disease is to place in the breeding-pens only birds of undoubted vigour and constitution. Where trouble has been experienced in the past, by taking extra care in the selection of the breeding-stock, the owner will go a long way towards correcting matters.

At times when there is a tendency for a poultry-keeper to become too satisfied with his own birds more visits to other farms, especially where quality is a strong feature, and careful comparison of the stock, are well worth while.

The most successful poultrymen are amongst those who have gained their knowledge slowly along the road of practical experience, and very often they have been greatly helped by closely observing other successful men who have always taken extra care in the selection of their breeding birds. A person may start off with little experience, on fresh ground and with a few good birds of a strain that has taken years to build up, and obtain wonderful results for the first year or so, but very often the returns in subsequent years are not so good. This generally is due to the fact that the ground is becoming tainted, and that there has been an endeavour to increase his flock too quickly before he has had time to gain sufficient experience in the art of selecting breeding-stock.

Fresh Blood.

Those requiring fresh Leghorn blood for next season's breeding-pens may secure a change from this Department's Wallaceville Poultry Station during the coming season. Last July this Department imported from the New South Wales Government one hundred White Leghorn and one hundred Langshan eggs, and cockerels reared from the Leghorn eggs are now mated to some Wallaceville hens, and sittings of eggs, in limited quantities, *not exceeding five dozen* for any one order, may be procured at 6s. 6d. per dozen, postage free. Those requiring eggs from these matings should apply early to the Poultry Overseer, Veterinary Laboratory, Private Bag to Wallaceville, Wellington.

Some Brooding Notes.

Methods of artificial brooding have been much improved of late years, and to-day the most popular brooder in this country is the canopy-shaped type of electric or lamp-heated brooder. However, success with any particular system depends upon experience and the individual care and attention to detail.

One of the first essentials is cleanliness, and every care should be taken to see that the brooder-house and brooders are thoroughly cleaned and disinfected. Where the brooder-house has been used during the year for the housing of adult birds, extra care should be taken to guard against disease germs. Caustic soda and boiling water are the best for this purpose, and the floor and walls should receive a good soaking. Outbreaks of coccidiosis and other troubles have been traced to a neglect of this very important matter.

Another important matter is to guard against dampness, especially where a large number of chickens are brooded together under a canopy brooder. One of the best ways of protecting the chickens against dampness is to use a wire-netting frame as described on page 71 of this Department's Bulletin No. 66, "Utility Poultry-keeping," copies of which may be had from the Publisher, Department of Agriculture, Wellington, C. 1, price 1s., postage free.

Plenty of clean, dry bedding should be used. Straw chaff is the best material for this purpose. After the chickens are three weeks old it pays to put a little fresh chaff under the brooder each night for the chickens to sleep on, but never put clean litter on top of damp or dirty material. Damp litter is often the cause of brooder pneumonia. No ground draughts should disturb the chickens at night, as this will cause them to crowd. A close watch should be kept on the chickens just as they are settling down for the night, and if they are inclined to crowd they should be gently spread out. Generally, chickens will start to crowd into heaps under the brooder after a week or ten days. However, if care is taken to prevent this by being in attendance just at camping-time much trouble will be avoided. This, in the writer's opinion, is one of the secrets of rearing a large number of chickens under one brooder. If allowed to camp in large heaps they do not thrive.

Feeding of Chickens.

There are many methods of feeding chickens, and most successful poultry-keepers have their own system. The following method was adopted by Mr. H. Kitto, Poultry Instructor, while he was Overseer of the Wallaceville Poultry Station, and has been used with success for some years.

The chickens are transferred from the incubators to the brooders at night-time. On the following morning, usually about forty-eight hours after hatching, they are given their first meal. This consists of a grain mixture which is fed during the first seven days, and is made up as follows: 75 lb. finely-cracked wheat and 25 lb. finely-cracked maize. This mixture is apportioned out daily in quantities according to the number of chickens to be fed, and how they are eating.

Three meals per day are given, the first at 7.30 a.m., the second at 11.30 a.m., and the evening meal at 4.30 p.m. The quantity of the mixture which is intended to be given is first prepared by being soaked in hot water for about an hour before feeding-time. The grains are allowed to absorb sufficient moisture to cause them to swell. Finely-cracked oyster-shell grit is placed in open hoppers or boxes, to which the chickens have free access at all times.

Supply of Water.—At the same time as the first meal is given the chickens are provided with water to drink. When the chickens are four days old fresh skim-milk is given them to drink. While milk is being thus supplied,

water is not provided, milk being given alone as a drink until the chickens are old enough to go away from the heat. This, generally speaking, is when they are from six to eight weeks old, according to weather conditions.

After the chickens have been transferred from the brooders to the colony-houses, water is kept within easy reach always, but so long as an ample supply of milk is available it still is used.

Green Food.—On the fourth day green food—silver beet and young green oats, finely-cut up—is fed along with the other rations. When the chickens are seen to be consuming the green food, a regular supply is provided and is fed separately, between meal-hours, at 9 a.m., 2 p.m., and again after the last meal at 5 p.m.

Mash.—Commencing on the eighth day after hatching, the chickens are given two mash meals and one meal of grain per day. The grain-mixture remains the same as during the first week, but the grains used are a little larger each week, according to the development of the birds. The mash consists of two parts of wheat-meal to three parts of bran. This is moistened with sour milk, and every care is taken when mixing to produce it in as crumbly a condition as possible and not too pasty or too moist.

There is then no material change made in the diet until the age of eight weeks is reached. At this stage, and provided the chickens have done well, they should be big enough to be given whole grains with the exception of maize, which is a little too large.

—*C. J. C. Cussen, Chief Poultry Instructor, Wellington.*

THE APIARY.

Preparations for the New Season.

DURING the dormant season every spare moment should be spent in making preparations for the next season's work. All defective supers, roofs, and bottom-boards should be overhauled, and, where necessary, given a good coat of paint. This work, if delayed, is apt to interfere with the main work in the apiary when the bees are calling for special attention, and should not be postponed.

If it is desired to increase the apiary, hive and frame making should be pushed on and ample provision made for increase before the actual time arrives for putting plans into operation. Where the beekeeper does not make his own hives he should now order sufficient stocks to see him through the season. In the majority of cases it does not pay him to make his own appliances. Hive-manufacturing in the Dominion has been brought to a high standard, and unless the apiarist has ample capital to purchase machinery to turn out good hives he will find the home-made article too costly in the long-run. Whether the beekeeper is working on a small or large scale, he should aim at uniformity, and in building up an apiary decide at the beginning on the style of hive and frame he is going to use, and continue on those lines. Non-fitting supers and frames mean extra labour, and lead to endless trouble. The sizes in use are mostly ten and twelve-frame, and experience of his district enables the beekeeper to decide as to the best one to adopt.

To meet those cases where cost is a consideration, a durable frame-hive which complies with the provisions of the Apiaries Act can be made out of a petrol-case. Petrol-cases are obtainable for a few pence, and can be converted readily by any one handy with tools. A kerosene-case may also be used, but it will be found necessary to reinforce it, so that the petrol case is the handier. Particulars of a cheap home-made hive are given in the Department's Bulletin No. 128, "Bee-keeping."

Overhauling the Hives.

As advised last month, all supers should be removed and the bees confined to the brood-chamber. This keeps the bees snug and promotes brood-rearing, and at the same time facilitates the work of giving the hives their first spring overhaul. During the course of the winter there is usually an accumulation of pollen, dead bees, &c., on the bottom-boards, and consequently the latter require cleansing. All operations at this period should be carried out quickly as a safeguard against robbing. To cleanse the bottom-board a spare one should be brought into use. Set the hive temporarily on the spare board while scraping and cleansing the permanent one, then replace the hive on its permanent stand. See that the hives have a slight cant towards the entrance. This prevents moisture settling on the bottom-board, which is apt to cause the death of a considerable number of bees and besides it makes the hive damp and unwholesome.

Spring Work.

During August, whenever the temperature allows, the colonies may be given their first examination. It is highly important that this work be not postponed until brood-rearing has started in earnest, more especially in cases where ample stores were not left to carry the bees over early stages of this important function. Delay in making an examination may lead to spring losses, and nothing is more annoying than to find colonies dead through neglect to provide sufficient stores. Usually a colony's requirements are attended to in the late autumn, when the apiarist endeavours to gauge the amount of food requisite to carry the bees through the winter and spring periods. It may happen, however, that mild weather is experienced, when the drain on the stores to feed the young bees, if not supplemented, reduces a colony to starvation. Nothing should be left to chance during the critical months of spring, and no effort spared to see that each individual colony has sufficient food to meet current demands. Colonies which contain 15 lb. to 20 lb. of honey may be left until a later examination. If the hives contain less, they should be watched closely and preparation made for feeding. Bulletin No. 128, on page 27, contains information about the spring feeding of bees.

Queen-right Colonies.

The most important factor in a colony's condition is its queen. Advantage should be taken of the first examination to see that the queen is suitable in all respects. If a colony is in normal condition as regards strength and stores there should be fair-sized patches of brood in the centre frames, but this is not sufficient to determine that the colony is queen-right. The cells adjacent to the brood should be quickly examined for eggs, which are the only indication that the queen is present. If neither brood nor eggs are found, then the question of the colony being queenless should be shelved until about ten days later. At each examination make a note of each hive and its condition for future reference.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

Raising Seedling Plants under Glass.

DURING the summer, when the temperature of air and water approaches the optimum for raising seedlings under glass or outside, this operation is successfully carried out with much less attention than is necessary for the important operation of raising seedling plants in boxes under glass during the month of August for planting out about two months later. Sharp frosts and bursts of sunshine frequently occur then and make it difficult to maintain a steady soil and air temperature of about 60° F., or whatever may be the most suitable for the particular seeds being grown. It is only by

close attention, then, to the heating-system, water-temperature, and ventilation that good work may be done. Some growers are inclined to force the growth of the plants by means of high temperatures and humidity. The plants often look very fine until it comes to hardening them off before planting outside; then difficulties arise which have the effect of making establishment in the new quarters very slow, and of bringing about a considerable loss from disease, and a crop much below the average. Disease levies a heavy toll of plants when the soil is composed of poor materials inadequately prepared. Fresh rotted turf, stacked for twelve months or more; thoroughly decayed manure which has been stored under cover, and turned occasionally; with sharp sand mixed together in suitable proportions make a compost in which most of these seedlings may be raised with little trouble with proper attention to heat, water, and ventilation.

In the large-scale production of the present day it is customary to assist in guarding against loss from disease by sterilizing the compost before sowing the seeds; and many smaller growers, who perhaps in an emergency have to use a compost insufficiently prepared, often would be well advised to take the same precaution. Useful information on this subject is contained in the article on the control of damping-off by soil treatment by Brien and Chamberlain in the May number of this *Journal*. For the control of the fungi causing loss in this way steam-heating disinfection of the soil or treatment with formalin 1·25 per cent. is recommended. And what controls damping-off diseases in the soil controls many others—especially will steam-heating the soil do so.

Sterilizing by means of steam heat is commonly done by placing the soil in a shallow bin on a perforated false bottom beneath which steam is liberated. An oil-drum is sometimes used for the purpose. The head is cut out, perforated, and then used as a false bottom supported on a few bricks. In the side of the drum, beneath the false bottom, a pipe is fixed to which a steam-pipe is screwed and steam turned on until a temperature of 180° to 200° F. is obtained and held for twenty minutes, which is sufficiently long to control most of troubles under consideration. In some instances the space beneath the false bottom is enlarged, filled with water, which is boiled by means of a fire placed beneath it. Heating the soil by steam produced in this way is somewhat slower, but quite effective.

Besides destroying fungous spores, insects, weed-seeds, &c., the high temperature has considerable effect on the chemical and physical condition of the soil, particularly that part of it which is known as humus. These interactions have been the subject of considerable study by W. J. C. Lawrence and J. Newell, of the John Innes Horticultural Institution at Merton, where seedling-plants of many kinds are raised in large quantities in sterilized soil. As a result of their investigations they have evolved a composting technique which, they find, gives far better results that the old method, especially in the early stages of germination and seedling-growth. For seed-sowing and pricking off a mixture of loam, moss-peat, and sand is used, adding 1½ oz. superphosphate and 1 oz. pure chalk to each bushel of compost. The moss-peat is used instead of leaf-soil owing to its uniform quality and freedom from insects, fungous diseases, and weed-seeds, but additional drainage is necessary when it is used to replace leaf-soil. The loam and sand are sterilized separately, and the unsterilized moss-peat and fertilizers are added afterwards. The compost is then stored for six weeks and drawn from as required.

Lime mixed in the compost before sterilizing was found to be detrimental owing to its interaction with moss-peat when subject to heating by steam. As a result it was decided that no lime in any form should be added to soils before sterilizing.

It was this result which led to a general investigation of the behaviour, after sterilization, of the various ingredients used in composting. The greatest check to growth was obtained when loam, moss-peat, and sand were all sterilized together. The best plants were obtained where all the

ingredients were sterilized separately. These results are not confined to composts to which moss-peat is a part, as similar results are obtained when leaf-soil replaces moss-peat.

From the beginning of the experiments it had seemed clear that the marked increase of nitrogen which occurs in sterilized soil needed balancing by the addition of a suitable fertilizer. A series of experiments led to the adoption of the addition of superphosphate. As there was no advantage found in mixing it in before sterilizing, but, on the contrary, some plants made better growth when the phosphate was added afterwards, that course is generally recommended. Experiments carried out indicate that the sterilization of the soils changed the phosphatic requirement of the compost, and that that ingredient is a necessary complement of sterilized soil.

It is common experience among users of sterilized soil that the check to seedling-growth is most severe immediately after sterilizing, but that, on storing, the soil gradually recovers and can be used with safety after a month or two. The time needed for recuperation was known only vaguely, and tests were arranged to determine it more accurately. The standard seed-compost, including superphosphate, before described, was sown as soon as possible after sterilization, and further sowings were made at intervals of two days. Similar composts which had been prepared for some weeks were used as controls. In no case could any difference be detected in the rate of germination. These standard composts differ from ordinary fresh sterilized soil in only one important respect—viz., they contain added superphosphate and chalk. From these results it is clear that the addition of superphosphate almost immediately corrects the check to growth commonly associated with newly-sterilized soils.

These precautions, in order of their importance, are: (1) Lime must not be added to a soil before sterilizing; (2) the addition of phosphate is necessary to balance the changed soil conditions brought about by sterilizing; (3) composting should be done after, and not before, sterilizing; (4) fertilizers should be added after sterilizing. These are radical modifications to the usual present practice which might well receive the attention of growers here, especially those who are not getting the best results from their present methods.

Vegetable Crops.

Outdoors, in land that has been well prepared, sow during the month of August white turnips, globe-beet, early carrots, radishes, peas, onions, parsnips, parsley, lettuce, summer cabbage, and cauliflower; and plant out autumn-sown onions, artichokes, early potatoes, and asparagus.

On a hot-bed under glass sow tomatoes, chilis, peppers, celery, marrows, melons, and cucumbers, for planting out towards the end of October, or thereabouts. Steady growth, obtained chiefly by means of ample ventilation whenever weather permits, produces well-rooted sturdy plants which, when planted out, grow without a check and produce the best crops. Celery should be sown thinly: it is usually sown much too thickly. These crops usually suffer most from lack of attention to ventilation, which requires constant supervision during the changeable weather experienced at this season. Use water only when it is really necessary, and see that it is tepid.

A deep, light, rich, moist, well-drained soil in an open position, but sheltered from prevailing winds, is suited for the asparagus crop, which is best planted out now. Sturdy one-year-old plants from which all undersized specimens have been removed should be used. Plants should be from a good strain of seed of a proved variety.

Spacing and depth are important when planting asparagus. Commercial crops are best planted 5 ft. to 6 ft. between the rows and 18 in. between the plants. In the home garden they may be planted in a double row alternately, 18 in. between rows and plants. If more is required there should be a space of 4 ft. between the one double row and the next. Where white asparagus is required for canning, the soil is ridged up over the crowns, and to enable this to be done there must be a space of 7 ft. to 8 ft. between the rows. In

suitable land the crowns are planted 8 in. deep, covering them to a depth of 2 in. only at the time of planting, and allowing the trenches to be gradually filled later when hoeing. On drier land 10 in. is not too deep, and on rather heavy land 5 in. is sufficient. As with other plants, the roots must not be exposed to a dry atmosphere while being transplanted.

Towards the end of the month of August last season's parsnip crop will commence to grow, and the flavour of the roots will deteriorate. Before this happens they should be lifted and stored in a cool place.

Where tomatoes are to be planted out under glass the boxes of plants should be placed in the house to acclimatize for at least a few days before setting them out—for which operation they should be in a fairly moist condition.

Small and Sundry Fruits.

The successful grower has an intimate acquaintance with most of the insects and fungi which have taken up their abode in his crops, or that may possibly do so. The least symptom is noted, and, where necessary, steps are taken to meet the case. Where heavy cropping is done especially, this knowledge and action are indispensable if such cropping is to be maintained. The greatest measure of control is obtained by the application of preventive sprays made in early spring.

On established passion-vines laterals which have borne fruit should now be trimmed back to base buds, and the vines given a thorough application of Bordeaux 4–5–50 to prevent the spread of brown spot and scab disease. Only when seasonal pruning is done can this application be made effectively. It should be repeated at intervals of about one month as may be necessary. Infected untrained vines should be destroyed.

Where cane-blight and leaf-spot are attacking raspberries or loganberries, Bordeaux 4–5–50 should be applied just before growth commences. For the control of leaf-spot on currants and gooseberries the Bordeaux spray should be applied at the same stage of growth and repeated as may be necessary. Strawberry leaf-spot is very common, and, where present, Bordeaux 4–5–50 should be applied now and repeated at intervals of three or four weeks so long as it may be necessary.

Where caterpillars or chewing insects are also present ¾ lb. arsenate of lead powder should be added to each 50 gallons of spray. Where arsenate of lead paste is used 1½ lb. of that ingredient will be required. Materials required to make 4 gallons Bordeaux 4–5–50 strength are: 5 oz. bluestone, 6½ oz. lime, and 4 gallons water. If arsenate of lead is used 1 oz. powder or 2 oz. of paste should be added.

The Homestead Garden.

New wood on roses is sometimes killed during the spring by hard frosts, and when this occurs after pruning the results are serious. For that reason growers in cold localities sometimes defer pruning until the early part of September, when, in spite of any new terminal growth which may have been frosted, there will still be on the bushes plenty of dormant buds to which one may cut back and produce new growth during a safe period. Elsewhere rose-pruning should now be completed with other deciduous hardwood plants, followed by the pruning of such evergreen shrubs as require that attention either for the purpose of restricting growth or to encourage flowering. Special attention should be given to climbers on dwelling, walls, trellis, or pergola where uncontrolled growth interferes with painting and repairs and causes dampness and dirt to accumulate. *Wisteria, Bignonia, Bougainvillea, Actinidia,* vines and roses, with a little consideration, can be pruned and trained in a way which permits easy removal for painting and at the same time provides even a better display of blossom. Superfluous strong-wood shoots should be cut out entirely and only what is required to cover the trellis trained in.

Sow hardy annuals outside and half-hardy annuals in boxes on a hot-bed where a temperature of about 60° F. can be provided. Complete the planting of hard-wood and herbaceous perennial plants.

—W. C. Hyde, Horticulturist, Wellington.

WEATHER RECORDS: JUNE, 1936.

Dominion Meteorological Office.

NOTES FOR JUNE.

OWING especially to the absence of wind or severe southerly weather, June was a very mild month for winter. Frosts and the lack of rain caused the growth of pasture to be checked over much of the North Island, but elsewhere there was an unusual amount, and the quality is better than usual at this time of year. Stock are generally in excellent condition, but hoggets still rather backward in many places. In some places spring flowers are already showing. Farm-work is well advanced.

Rainfall.—Heavy rains in Hawke's Bay on the 16th, in Nelson on the 27th and 28th, and in parts of South Canterbury on the 15th and 29th were responsible for those districts having more than the average rainfall. The remainder of the country, however, had a very dry month. Less than half the average was recorded at many places, and in some it was the driest June on record.

Temperatures.—In Taranaki temperatures were slightly above normal, but in the remainder of the North Island, owing to the prevalence of south-westerly winds, they were considerably below. In the Waikato and the Bay of Plenty the departures were generally in the neighbourhood of 3° F. The west coast of the South Island and South Canterbury also had rather low temperatures. In the interior, however, means were as much as 3° F. and more above normal. In the fine, still weather of the first week there were many hard frosts, especially in the Bay of Plenty and Waikato districts. There is less snow than usual on the mountains.

Sunshine.—The duration of bright sunshine was above the average for June in most places, but Nelson, Hanmer Springs, and South Canterbury had less than the usual. Tauranga recorded 170·6 hours and Napier 167·8.

Storm Systems.—The month began with very high pressures ruling over the Dominion. Fine weather prevailed, with little wind. These conditions continued for a week, but on the 8th pressure began to fall, and on the 9th two depressions followed each other closely over the Dominion. General, though for the most part light to moderate, rain was experienced. Another anticyclone and several more fine days followed.

On the 15th a series of depressions commenced to traverse the country, the most important being one of cyclonic form, which passed on the 16th. General rains were experienced on the 15th and 16th, some large totals being recorded over much of the North Island. Rivers rose high, and some flooding was caused in the Bay of Plenty, Poverty Bay, Hawke's Bay, Wairarapa, and Manawatu districts. On the 18th strong south-westerly winds and cold temperatures set in, some snow falling on the ranges. Rather unsettled conditions still persisted for some days, but there was a gradual improvement and fine weather ruled from the 24th to the 26th.

On the 27th there began the passage of another set of complicated depressions, and, commencing in the western districts of the South Island, unsettled weather with general rain persisted from then onwards to the end of the month. During the 28th and the following night, a cyclone crossed the central portion of the Dominion. Gale winds were associated with it, and there was heavy precipitation in the Central Provinces and South Canterbury, with snow on the mountains. Some flooding occurred at Nelson.

The storm systems of the month were of unusual type, and the situation was seldom simple while depressions were passing. At this time of year one expects a rather regular eastward progression of alternate high- and low pressure areas, but during June these conditions failed to materialize.

RAINFALLS FOR JUNE, 1936, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average June Rainfall.	Total Rainfall to Date.	Average Rainfall to Date.
			North Island.			
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	3·75	17	1·20	6·59	28·02	28·16
Russell	3·12	13	0·80	6·49	57·27	27·33
Whangarei	2·20	20	0·42	6·54	36·86	31·60
Auckland	2·75	16	0·40	5·44	25·37	24·28
Hamilton	1·75	12	0·40	5·11	27·49	23·90
Rotorua	3·93	10	0·76	5·25	36·44	26·87
Kawhia	1·73	7	0·61	5·72	26·50	25·54
New Plymouth ..	3·26	16	0·79	5·95	28·26	28·54
Riversdale, Inglewood ..	5·36	16	1·25	10·27	45·73	48·65
Whangamomona ..	2·07	5	0·58	7·89	34·74	35·70
Hawera	2·45	13	0·48	4·41	22·62	21·39
Tairua	2·23	10	0·69	6·97	30·85	33·56
Tauranga	3·17	9	1·36	5·35	33·28	26·88
Maraehako Station, Opotiki	2·12	10	0·36	5·66	33·39	27·79
Gisborne	2·15	14	0·90	4·90	28·47	24·91
Taupo	2·66	10	0·78	4·56	26·29	21·36
Napier	5·85	11	4·49	2·92	33·59	16·08
Hastings	4·70	6	4·05	3·07	30·18	16·63
Whakarara Station ..	3·75	6	0·95	..	35·68	..
Taihape	3·14	15	1·03	3·38	25·95	17·81
Masterton	2·84	9	1·45	3·59	28·02	18·77
Patea	2·67	12	0·52	4·24	24·63	21·40
Wanganui	2·03	10	0·88	3·37	22·28	17·70
Foxton	1·73	8	0·74	3·39	20·65	15·27
Wellington	3·33	13	0·72	4·31	27·41	20·89
			South Island.			
Westport	6·39	13	1·47	8·85	31·30	46·50
Greymouth	5·32	15	1·86	8·80	35·25	49·56
Hokitika	8·13	15	3·74	9·22	37·59	55·09
Ross	6·84	10	3·29	8·73	42·59	62·77
Arthurs Pass ..	..	..	..	10·53	..	75·94
Okuru, South Westland	9·59	11	2·75	10·72	63·67	72·04
Collingwood	8·22	10	2·81	10·30	39·77	45·08
Nelson	3·97	7	1·91	3·51	16·28	18·32
Spring Creek, Blenheim	2·41	8	1·45	2·94	17·50	14·47
Seddon	1·50	9	0·85	2·09	14·72	12·32
Hanmer Springs ..	1·57	8	0·59	3·39	29·34	21·77
Highfield, Waiau ..	1·66	6	0·55	2·47	23·29	16·74
Gore Bay	1·58	8	0·47	2·69	20·89	15·87
Christchurch	0·82	12	0·45	2·53	19·30	12·63
Timaru	2·29	5	1·08	1·75	18·07	11·14
Lambrook Station, Fairlie	2·05	7	1·39	1·86	15·38	11·98
Benmore Station, Clearburn	1·00	7	0·68	1·81	8·50	12·80
Oamaru	0·96	8	0·63	1·98	15·06	10·98
Queenstown	0·48	10	0·11	2·22	15·02	15·35
Clyde	0·84	4	0·46	0·92	6·67	7·76
Dunedin	1·21	14	0·35	3·14	21·19	18·08
Wendon	0·80	12	0·25	2·59	14·76	15·48
Balclutha	1·44	13	0·50	1·99	13·84	12·71
Invercargill	2·76	18	0·55	3·64	21·15	23·31
Puysegur Point ..	4·81	20	0·74	6·59	39·48	42·26
Half-moon Bay ..	3·99	16	0·77	4·91	21·38	29·13